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(54) METHOD AND APPARATUS FOR CREATING ENCRYPTED AND DECRYPTED TELEVISION SIGNALS.

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EP-A- 0 099 691
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US-A- 4 335 393
US-A- 4 390 898

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Description

This application is a continuation-in-part of Applicants' Application Serial No. 507,565 filed June 24, 1983 corresponding to US-A-4 642 688 published on February 10, 1987.

The present invention relates to the field of television signal transmission and, more particularly, is directed to a method and apparatus for creating a television signal and encrypting or decrypting the signal at the same time.

Television signals are produced and displayed as a result of a line scanning process. The picture information is scanned using a progressive series of horizontal lines which are transmitted sequentially in time. The transmitted signal is a continuous analogue of the brightness intensity corresponding to each point of the line. Such a signal is shown in Figure 1 from which it may be seen that in a series of standard lines, any two adjacent active line periods (periods during which video information is transmitted) are separated by a period in which no video information is transmitted. This latter period is known as the line blanking interval and is introduced to allow the scanning device in the receiver to reset to the line-start position.

In typical color television signals, the active line period includes one signal which simultaneously represents the instantaneous values of three independent color components. The method by which the three color components are coded into one signal is standardized throughout North America, Canada and Japan. This method is known as the NTSC standard. Alternative standards known as PAL and SECAM have been adopted in other countries but these standards have the same basic format as the NTSC standard, including a line-blanking interval and an active line period in each scan line.

Other types of analogue video signals which are particularly adapted to transmission by satellite and cable, and which lead to improved picture quality in comparison with existing standards, are presently being studied. These signals are based on a time multiplex of the three independent color components during the active line period of the scan line. Instead of coding the three components into one signal using the NTSC, PAL or SECAM standard, the components are sent sequentially using a time-compression technique. One version of this type of signal is know as MAC (Multiplexed Analogue Components). Signals generated by a time compression technique also adhere to the same basic format as the NTSC, PAL and SECAM standards, including the presence of a line-blanking interval and an active line. period in each scan line. It should be noted that when a MAC signal is employed, digital data may also be transmitted during the line-blanking interval as shown by the dotted lines in Figures 2a and 2c.

Color video signals broadcast under the NTSC standard require that picture information be separated into two components: luminance, or brightness, and chrominance, or color. Figure 10 is an amplitude-vs.-frequency diagram illustrating, in simplied form, a typical NTSC composite color television signal 50 comprising a luminance signal 52 and a chrominance signal 54. (A composite television signal is one in which chrominance information is carried on a subcarrier.) The signal occupies a nominal bandwidth of 6 MHz with the picture carrier 56 being 1.25 MHz above the lower end of the band. Luminance information is modulated directly onto picture carrier 56, while chrominance information is modulated onto color subcarrier 58 which is in turn used to modulate picture carrier 56. Color subcarrier 58 has a frequency of 3.579545 MHz, a standard established by the NTSC. (Audio information is carried on another subcarrier 40 lying near the upper edge of the band.)

The region labeled A in Figure 10 is of particular importance for it represents overlap between the luminance 52 and chrominance 54 signals. Since separation of luminance and chrominance is accomplished by filtering a frequency-division multiplexed signal, overlaps such as A between the two signals lead to several problems. If, upon reception, complete separation between luminance and chrominance is desired, the necessary filtering will cause the loss of some of the information in both signals. On the other hand, if no loss of information can be tolerated, then one must accept interference between the luminance and chrominance signals. Moreover, since the various parts of the NTSC television signals are transmitted at different frequencies, phase shifts occurring during transmission will affect them differently, causing the signal to deteriorate. Also, the available color information is severely limited by the small color bandwidth permitted.

As discussed in commonly assigned pending Application Serial No. 652,926 filed September 21, 1984 corresponding to US-A-4 652 903 published on March 27, 1987, the above-mentioned MAC standard was developed to overcome the problems associated with the NTSC standard. A MAC color television signal is illustrated in Figure 11, which is an amplitude-vs.-time diagram of a single video line of 63.56 us duration. The first 10.9 us is in the horizontal blanking interval (HBI) 62, in which no picture information is transmitted. Following HBI 62 are chrominance signal 64 and luminance signal 66, either of which may be time-compressed. Between chrominance signal 64 and luminance signal 66 is a 0.28 us guard band 68, to assist in preventing interference between the two signals.

The MAC color television signal of Figure 11 is obtained by generating conventional luminance and chrominance signals (as would be done to obtain a conventional NTSC or other composite color televi-

sion signal) and then sampling and storing them separately. Luminance is sampled at a luminance sampling frequency and stored in a luminance store, while chrominance is sampled at a chrominance sampling frequency and stored in a chrominance store. The luminance or chrominance samples may then be compressed in time by writing them into the store at their individual sampling frequency and reading them from the store at a higher frequency. A multiplexer selects either the luminance store or the chrominance store, at the appropriate time during the active line period, for reading, thus creating the MAC signal of Figure 11. If desired, audio samples may be transmitted during the HBI; these are multiplexed (and may be compressed) in the same manner as the video samples. The sample rate at which all samples occur in the multiplexed MAC signal is called the MAC sampling frequency.

Although the MAC format of Figure 11 overcomes the problems of the composite television signal of Figures 1 and 10, there also exists in the prior art a need for secure encryption of video signals, such that only designated users may decrypt and display the information. In typical encryption systems, one or more parameters of the signal to be encrypted are modified according to a pattern which is determined at the transmitter. The pattern generally is a member of a large class of similar patterns, such that discovery of the pattern through exhaustive search is extremely unlikely. A precise description of the pattern used for encryption is delivered to designated receivers which then are able to recover the original information. The description of the pattern is known in the art as the "encryption key" and the process of informing designated users of the encryption key is known a "key distribution."

With reference to Figure 1, various encryption techniques known in the art will be described. As shown in Figure 1, the video signal during the active line period may be represented by:

$y = f(t)$

where

y = amplitude (voltage) and

t = time

Knowledge of both the signal's amplitude (y) and the time at which it occurs (t) is necessary for accurate reconstruction of the video signal in a line scan system.

Encryption techniques may be classified as follows:

(1) Those which modify the amplitude (y) of the transmitted signal according to a prescribed pattern.

$y' = g(f)$, where $f = f(t)$

Examples of this technique include amplitude reversal of randomly chosen lines:

$y' = g(f) = -f$

(2) Those which modify the time at which the signal is transmitted through the channel:

$y' = f(t')$

Examples of this technique include the reordering of television lines according to a prescribed pattern:

$y' = f(t-d)$

(3) Those which modify both amplitude and transmission time.

It has been found that encryption techniques from the first category (variation of amplitude) cause distortion when the channel through which the signal is to be passed is non-linear. In this case, an amplitude (y) will be represented in the scrambled channel by various amplitudes according to the scrambling function in use at that instant. Channel non-linearity, therefore, causes imperfect reconstruction of the video information at the receiver. Since amplitude non-linearity is very common, it has been found that an optimum encryption algorithm should be selected from the second category, and, in particular, from the subset:

$y' = f(t-d)$

where d is constant during each standard line. In this case, the channel is subjected to an undistorted signal and only the time at which the signal occurs is scrambled. Since almost all channels are essentially 'time invariant,' this technique introduces little distortion. This system is known as time-base scrambling.

An obvious method of time-base scrambling which has been used, is to reorder the television lines within the picture. This method, which results when d in the previous equation is an integral number of line periods, is complex, expensive and difficult to implement because recovery of the picture in the receiver demands storage of many television lines.

It is, therefore, the overall object of the present invention to provide a method and apparatus for creating a television signal while at the same time encrypting and decrypting the signal.

It is a specific object of the present invention to provide a method and apparatus for time-base scrambling of television signals which is relatively simple and which can be readily implemented.

It is another specific object of the present invention to provide a method and apparatus for time-base scrambling of television signals which can be implemented at low cost while at the same time being reliable in operation.

It is a still further specific object of the present invention to provide a method and apparatus for time-base scrambling of television signals which requires storage of only a very small number of television lines in the receiver.

It is another specific object of the present invention to provide a method and apparatus for creating an encrypted MAC standard television signal for transmission and for creating a decrypted NTSC standard television signal for display on a television

receiver.

According to a first aspect of the invention there is provided an apparatus for creating an encrypted part of a MAC television signal comprising luminance information and/or chrominance information, said apparatus comprising:

input means for receiving a scan line of television signal information;

storage means coupled to the input means, the storage means being adapted to store said scan line of said information, and output means adapted to subsequently read out the stored scan line of information to create the part of the MAC television signal; and

the part of the MAC television signal being read out of the storage means in accordance with an encryption key; characterised in that the storage means comprises first and second memory means for storing said information and first and second clock signal means coupled to the respective first and second memory means;

wherein said first clock signal means is adapted to cause said first memory means to store a first present scan line of said information as a predetermined number of first samples at a first sampling frequency, and said second clock signal means causes said second memory means to read out a stored scan line of information at a second sampling frequency whilst the first present scan line is stored;

wherein said second clock signal means is adapted to cause said second memory means to store a second present scan line of said information as said predetermined number of second samples at the first sampling frequency and said first clock signal means causes said first memory means to read out the stored first present scan line of information at the second sampling frequency whilst the second present scan line is stored, the second sampling frequency being greater than the first sampling frequency, and wherein said first and second clock signal means cause the respective first and second memory means to delay reading out said stored scan lines of information in accordance with said encryption key.

According to a second aspect of the invention there is provided apparatus for decrypting an encrypted part of a MAC standard television signal as provided in claim 10.

According to a third aspect of the invention there is provided a method of producing an encrypted part of a MAC standard television signal as provided in claim 19.

According to a fourth aspect of the invention there is provided a method of decrypting an encrypted part of a MAC standard television signal as provided in claim 22.

The same apparatus can thus be used to encrypt and decrypt the television signal. In accordance with the present invention, a MAC standard television signal may be created and encrypted for transmission to a remote receiver. At the receiver end, the MAC signal may be used to create a decrypted signal, as for example an NTSC signal, for display on a television receiver. The MAC signal is created at the transmitter end by sampling and storing the luminance and chrominance signals separately. Luminance is sampled at a luminance sampling frequency and stored in a luminance store while chrominance is sampled at a chrominance sampling frequency and stored in a chrominance store. The luminance and chrominance samples are compressed in time by writing them into the store at their individual sampling frequency and reading them from the store at a higher frequency. A multiplexer selects either the luminance store or the chrominance store, at the appropriate time during the active period of the video scan line, for reading, thus creating the MAC signal. The signal may be encrypted by varying the starting time at which the luminance and/or chrominance signals are read out from their respective stores in accordance with an encryption key.

At the remote or receiver end, a decrypted signal, e.g., an NTSC signal, may be created for display on a television receiver using the same method and apparatus as used to create the encrypted signal at the television transmitter end. This is accomplished by also storing the incoming luminance and chrominance signals in individual stores. The signals are read out from the stores at a frequency corresponding to the desired format, i.e., the NTSC standard. The signal is decrypted by varying the starting time at which the luminance and/or chrominance signals are read out from their respective stores in accordance with a decryption key.

Thus, the method and apparatus of the present invention may be used for creating an encrypted television signal for transmission to a remote receiver and for creating a decrypted signal at the receiver for display. Accordingly, a television broadcast system which embodies the present invention uses fewer component parts, is simplier in construction, more reliable in operation and is lower in cost.

Figure 1 shows a standard NTSC television signal;

Figures 2a, 2b and 2c illustrate the encryption technique employed in the present invention;

Figure 3 shows one form of an encryption/decryption system which may be used with the present invention;

Figure 4 shows an alternative system to that shown in Figure 3;

Figure 5 illustrates another embodiment of an encryption system;

Figures 6 and 7 illustrate two different decryption systems;

Figure 8 shows a decryption system embodying an aspect of the invention and surrounding equipment;

Figure 9 illustrates apparatus that may be em-

ployed for the encryption and decryption of video signals by a technique embodying the present invention;

Figure 10 is an amplitude-vs.-frequency diagram illustrating in simplified form a typical NTSC color television signal;

Figure 11 is an amplitude-vs.-time diagram of a single video line of a typical MAC color television signal;

Figure 12 is a block diagram of a line store which may be used to compress or decompress television scan lines in accordance with the present invention;

Figure 13 is a block diagram of the clock signals used to control the line store shown in Figure 12;

Figure 14 is a block diagram of an encoder which may be used with the present invention;

Figure 15 is a block diagram of a decoder which may be used with the present invention; and

Figures 16a and 16b are diagrams illustrating the signals input to and output from the line store of Figure 12.

The encryption and decryption method of the present invention is based on the derivation and use of a variable scan line period as shown in Figures 2a-2c. Referring to Figure 2a, portions of the active video components of lines N and N+1 are shown along with the line-blanking interval of line N + 1. The line shown in Figure 2a is of standard length and thus includes a standard line-blanking interval. As discussed previously, and as shown in dotted outline in Figure 2a, instead of there being a line-blanking interval, there may be a period of standard length for transmission at digital data.

A line of minimum length is shown in Figure 2b and is obtained by virtually eliminating the standard line-blanking interval or the period of digital data transmission.

A line of extended length is shown in Figure 2c and is obtained by increasing the standard line-blanking interval or the period of digital data transmission shown in Figure 2a, the dotted outline in Figure 2c also indicating digital data.

An extended length line of the type shown in Figure 2c can be derived with simple hardware in the case where the line-blanking interval is double the line-blanking interval of Figure 2a. In fact, the extended length line of Figure 2c is such a line and has twice the line blanking interval of the standard line of Figure 2a.

Encryption is achieved according to the present invention by varying the line-blanking intervals of some of the lines to derive minimum and extended length lines. The transmitted television signal is then composed of lines of all three different lengths in accordance with an encryption key.

It will be appreciated that over some specified period of time it is necessary for the average line length to be equal to the length of a standard line, i.e., that the long and short lines must cancel or balance each other out. This period is not critical. It may be one field, for example, or one frame, or it may be even a longer period. The longer this period is, however, the longer it will take for the receiver to lock in on the signal.

While Figures 2a-2c illustrate an embodiment of the invention where the line-blanking interval is standard, zero and two times standard, line-blanking intervals between zero and standard can be employed as well as line-blanking intervals more than twice standard and/or between one and two times standard. There may also be a number of different line-blanking intervals greater than standard. Generally speaking, however, employing a standard and more than two other line blanking intervals can be done only at the expense of more sophisticated hardware.

In another embodiment of the invention, no standard length line is employed, i.e., the line-blanking intervals of all lines are lengthened or shortened. Thus, in the practice of the present invention a television signal is modified in accordance with an encryption key to produce a signal in which all active video lines are transmitted unchanged except for a time delay equal to the accumulated variance in the line-blanking periods. More specifically, and as determined by the encryption key, some lines may be left with unchanged line-blanking intervals, the line-blanking intervals of other lines are increased and the line-blanking intervals of still other lines are decreased. The encrypted television signal is composed of all of these lines and is what is transmitted, the encryption key indicating which lines are standard lines, which lines are long lines and which lines are short lines to enable decryption of the received signal.

One additional condition is required to ensure a low-cost receiver. This condition is that the accumulated change of the line-blanking periods at any given time should remain within the range of from 0-1 line. With this constraint, the lines which arrive at the receiver do not require more than one line of delay before they are used in reconstructing the original signal, i.e., the signal prior to encryption. It is to be understood clearly, however, that this is not a limitation of the present invention. If the accumulated change in the line-blanking periods at any given time will be more than one line, all that is required is to ensure that apparatus capable of storing the accumulated change is available. This requirement simply introduces greater cost and complexity.

Because certain of the line-blanking periods have been completely or partially removed, it is necessary to regenerate the blanking waveforms in the receiver. This can be achieved simply using electronic memories. More specifically, in the case of an NTSC signal, for example, regeneration of the line-blanking intervals will require regeneration of the line synchronizing

signals and the color burst signals. This can be done using prior art techniques, however, and is not a part of the present invention. Thus, once the decryption key, which is the same as the encryption key, has been employed to restore the active video components to their proper time relationship with respect to each other, sync and color burst signals correctly timed with respect to the video signals can be added readily and by known means.

In the case where digital data is present during what would otherwise appear to be a line-blanking interval, it might appear from Figure 2b that the digital data would be lost by the practice of this invention. The data is not lost, however, but rather is transmitted during longer than standard digital data periods, as shown in Figure 2c, for example.

The encryption/decryption technique described herein can be implemented in a large number of ways using known techniques, equipment and components. Thus, referring to Figure 3, for example, the television signal produced by TV camera 12 is supplied to an optional analogue to digital converter (ADC) 13, the digital output of which is supplied to a line storage device 14. The output of line storage device 14 is supplied to an optional digital to analogue converter (DAC) 15 whose output, which is an encrypted television signal in analogue form, Is supplied to a transmitter 16 for broadcast to a satellite 17, for example. An encryption key for encrypting the television signal in line storage device 14 is supplied to encoding and timing networks 18 which vary the line-blanking intervals of the television signal.

The encrypted signal is received by a cable head end receiver 19 and is supplied to an optional ADC 20 whose digital output is supplied to a line storage device 21. The output of line storage device 21 is supplied to an optional DAC 22 whose output, which is a decrypted TV signal the same in all respects as that derived at the output of camera 12, is supplied via cable to cable subscribers. A decryption key, which is the same as the encryption key, for decrypting the television signal in line storage device 21 is supplied to decoding and timing networks 23 which restores the shortened and extended line-blanking intervals to the standard length shown in Figure 2a.

In the case where the TV signal is an NTSC signal, for example, it may be necessary to restore line and field synchronizing signals and color burst signals. This function is performed by blanking interval regenerating network 24.

The TV signal may be processed in either analogue or digital form. The nature of line storage devices 14 and 21 will depend upon the format of the signal. Thus, if the TV signal is in analogue form, line storage devices 14 and 21 may be so-called bucket-brigade devices, while, if the TV signal is in digital form, line storage devices 14 and 21 may be shift registers or may be RAM with at least one line memory capacity or CCD storage devices.

Figure 8 shows a decryption system embodying the present invention in somewhat greater detail.

Figure 9 shows how the decryption (or encryption) key is used to vary the line lengths. The decryption key (which in the embodiment shown, is updated once a frame) is used as a starting vector for a pseudo-random number generator circuit. This circuit produces (for the NTSC standard) a sequence of 525 random numbers based on the decryption key. These random numbers then are combined with information derived from a counter, which is incremented once per line, in a line type selection circuit. This circuit selects the type of line (i.e., determines the length of the blanking interval) for the next line. This information is then fed to the line length controller which monitors the aggregate deviation in line lengths referenced to the start of the current frame and ensures that for this particular embodiment the following two conditions are met:

1. The aggregate deviation never exceeds one full video line (63.56 u sec for an NTSC signal);
2. The aggregate deviation at the end of the frame is zero.

The line length controller then provides information to the horizontal counter and its associated decoder which enables this counter/decoder to produce the correct line store control signals for the current line.

As pointed out above, use of the MAC standard for transmission of television signals eliminates many of the problems associated with the NTSC standard. Figure 12 is a block diagram of a line store which may be used to compress or decompress luminance and chrominance signals to create a MAC standard television signal. The store comprises a pair of memory elements 33 and 34 coupled to a common input 35 which receives either luminance or chrominance, i.e., color difference signals. Memory elements 33 and 34 may be selected from among a number of memory elements known in the art and are shown in Figure 12 as being CCD memory elements. Memory elements 33 and 34 are coupled to respective clock signals 30 and 31 and to selector switch 36. Switch 36 is an electronic switch or multiplexer well known in the art and which has a double-pole-single-throw (DPST) function. Each respective output line of memory elements 33 and 34 are coupled to switch 36 and selectively passed to output line 37 as controlled by output select signal 32.

Though the line store of Figure 12 may be used to both compress and decompress signals, the device is described hereafter as performing compression. When a signal, as for example a luminance signal, arrises at input 35, clock 30 writes a predetermined number of luminance samples into memory element 33 at a predetermined incoming sampling frequency. It has been found that a suitable number of samples is 750

and that a suitable incoming sampling frequency is 14.32 MHz for a luminance signal in accordance with, for example, the NTSC standard. At the same time that memory element 33 is storing the incoming luminance signal, clock 31 is causing the contents of memory element 34 (luminance signals from the previous scan line) to be read onto output line 37 through switch 36 at a predetermined outgoing sampling frequency. It has been found that a suitable outgoing sampling frequency is 21.48 MHz. During the next scan line, the 750 luminance samples are written into memory element 34 by clock 31, operating at the incoming sampling frequency of 14.32 MHz. At the same time, the luminance samples stored in memory element 33 are read out to output line 37 by clock 30 at the outgoing sampling frequency of 21.48 MHz. A separate line store having a pair of memory elements is used to compress the color difference signals (i.e., chrominance signals) and operates in a similar manner. Figure 13 is a block diagram of the clock signals used to control the operation of memory elements 33 and 34.

Figure 14 is a block diagram of an encoder which may be used with the present invention and includes the line store shown in Figure 12 for storing and subsequently reading out the luminance and chrominance signals. As shown, three color television signals, luminance (Y) and two color difference signals (R - Y and B - Y) are delivered from a television signal source and are filtered, respectively, in low-pass filters 100a, 100b and 100c. The filtered signals are then sampled at the appropriate incoming sampling frequency in A/D converters 102a, 102b, and 102c.

Vertical filters 104 and 106 provide vertical interpolation of the digital color difference signals R - Y and B - Y, respectively, after which these signals are selected alternately for transmission by multiplexer 108. Only one of the two color difference signals need be sent as chrominance in each line in order to create a MAC television signal.

The digital luminance and chrominance signals are next compressed as described above. Luminance data are written into and read from luminance store 38a. Chrominance data are written into and read from chrominance store 38b.

Multiplexer 118 receives four sets of signals, luminance, chrominance, audio, and synchronization. Multiplexer 118 then combines these signals by selecting them at the appropriate time for inclusion in the MAC video line. After multiplexing, the signals are reconverted to analog in D/A converter 120, filtered in low-pass filter 122, and output as a MAC color television signal.

Figure 15 is a block diagram of a decoder which may be used with the present invention and also includes the line stores shown in Figure 12. The incoming television signal first enters the demultiplexer 300, which separates from it the luminance and chrominance signals as well as the audio and synchronization signals. The luminance signal is delivered to luminance store 38a where it is decompressed, and then to low-pass filter 304, where it is filtered. The analog luminance signal then goes to output interface 306. The sampling signals necessary to decompress luminance are produced in timing generator 308 and supplied to luminance store 38a by two clock drivers 310.

The chrominance signal from demultiplexer 300 is also decompressed in chrominance store 38b. Separate outputs are provided for the two color difference signals, which are filtered in two low-pass filters 314 and then supplied to output interface 306. The necessary sampling signals are supplied to chrominance store 38b from timing generator 308 through three clock drivers 310.

Signals not constituting luminance or chrominance are also separated from the incoming television signal by demultiplexer 300. Output Interface 306 receives luminance from low-pass filter 304, chrominance from low-pass filters 314, and timing signals from timing generator 308. Its output is a standard NTSC color television signal.

In accordance with the present invention, the line store of Figure 12 may also be used to encrypt the television signal at the transmitter end during the creation of a MAC signal and to decrypt the created signal at the receiver end for display on a television receiver. Thus, the line store of Figure 12 may be used to replace stores 14 and 21 shown in Figure 3 to create an encrypted signal with respect to store 14 and to create a decrypted signal with respect to store 21. As shown in Figure 9, an encryption/decryption key is supplied to networks 23 which controls the generation of control signals for the line store. These signals include clock signals 30 and 31 and output select signal 32. Depending on the type of memories used for the memory elements within the line store, the control signals may also include read, write and memory refresh signals.

Figures 16a and 16b are diagrams illustrating the signals input and output from the line store of Figure 12. To simplify the illustration and explanation, it is assumed that the line store is being used to compress a luminance signal, that the length of a standard scan line L is 64 us and that the length of the horizontal blanking interval is 12 μs. Thus the length of the active or video portion of the scan line is 52 μs. Figure 16a represents the operation of memory element 33 while Figure 16b represents the operation of memory element 34.

As shown in Figure 16a, 750 samples of luminance are taken at a sampling frequency of 14.32 MHz over 52 μs of the scan line and stored in memory element 33. After a delay in accordance with the encryption key, these samples are read out at a sampling frequency of 21.48 MHz. The higher sampling

frequency causes the samples to be read out much faster than they were read in, i.e., the incoming samples took 52 μs to read in but only 34 μs to read out. Therefore, compression of the incoming luminance singal is accomplished, thereby creating a luminance portion of MAC standard signals. Because readout of the samples is delayed in accordance with an encryption key, the MAC signal is also simultaneously encrypted. As can be seen from Figure 16a, the length of the delay before reading out the stored samples can vary from 0 to 42 μs. A delay longer than 42 μs will not permit the samples to be completely read out prior to the arrival of a new scan line for storage.

Memory elements 33 and 34 operate in tandem, while one memory element is reading in luminance samples, the other memory element is reading out luminance samples from the previous scan line in MAC standard format. Thus, each memory element operates on alternate scan lines.

Likewise the line store of Figure 12 could be used to decrypt the signal at the receiver while simultaneously decompressing the signal. In that event, the luminance signal will be read into the line store at 21.48 MHz and read out at 14.32 MHz to decompress the signal. The readout time can be controlled in accordance with a decryption key to simultaneously decrypt the signal.

Claims

1. An apparatus for creating an encrypted part of a MAC television signal comprising luminance information and/or chrominance information, said apparatus comprising:

   input means (35) for receiving a scan line of television signal information;

   storage means (38) coupled to the input means (35), the storage means (38) being adapted to store said scan line of said information, and output means (37) adapted to subsequently read out the stored scan line of information to create the part of the MAC television signal; and

   the part of the MAC television signal being read out of the storage means (38) in accordance with an encryption key; characterised in that the storage means (38) comprises first and second memory means (33, 34) for storing said information and first and second clock signal means (30, 31) coupled to the respective first and second memory means (33, 34); wherein said first clock signal means (30) is adapted to cause said first memory means (33) to store a first present scan line of said information as a predetermined number of first samples at a first sampling frequency, and said second clock signal means (31) causes said second memory means (34) to read out a stored scan line of information at a second sampling frequency whilst the first present scan line is stored; wherein said second clock signal means (31) is adapted to cause said second memory means (34) to store a second present scan line of said information as said predetermined number of second samples at the first sampling frequency and said first clock signal means (30) causes said first memory means (33) to read out the stored first present scan line of information at the second sampling frequency whilst the second present scan line is stored, the second sampling frequency being greater than the first sampling frequency, and wherein said first and second clock signal means (30, 31) cause the respective first and second memory means (33, 34) to delay reading out said stored scan lines of information in accordance with said encryption key.

2. The apparatus of claim 1 wherein said predetermined number is 750, said first sampling frequency is 14.32 MHz and said second sampling frequency is 21.48 MHz.

3. The apparatus of claim 1 or 2, wherein said first and second memory means (33, 34) comprises RAM memory.

4. The apparatus of claim 1 or 2, wherein said first and second memory means (33, 34) comprises a plurality of shift registers.

5. The apparatus of claim 1 or 2, wherein said first and second memory means (33, 34) comprises a plurality of CCD elements.

6. The apparatus of claim 1 to 5, wherein said information comprises luminance information, the apparatus further comprising chrominance storage means (38b) coupled to said input means (35) for storing a scan line of said chrominance information and subsequently reading out said stored scan line of chrominance information to create another part of said MAC standard signal.

7. The apparatus of claim 6, wherein said chrominance storage means (38b) includes first and second memory means (33, 34) coupled to said first and second clock signal means (30, 31) respectively, said first clock signal means (30) being arranged to cause said first memory means (33) of said chrominance storage means (38b) to store a first present scan line of said chrominance information when said second clock signal means (31) causes said second memory means (34) of said chrominance storage means (38b) to read out a first stored scan line of chrominance information, said second clock signal means (31)

being arranged to cause said second memory means (34) of said chrominance storage means (38b) to store a second present scan line of said chrominance information when said first clock signal means (30) causes said first memory means (33) of said chrominance storage means (38b) to read out the stored first present scan line of chrominance information, wherein said first and second clock signal means (30, 31) causes said first and second memory means (33, 34) of said chrominance storage means (38b) to delay reading out said stored scan lines of said chrominance information in accordance with said encryption key.

8. The apparatus of claim 7 wherein said first and second clock signal means (30, 31) causes said respective first and second memory means (33, 34) of said chrominance storage means (38b) to store a predetermined number of samples of said chrominance information at a first chrominance sampling frequency and to read out said stored scan line of chrominance information at a second chrominance sampling frequency.

9. The apparatus of claim 8 wherein said predetermined number of samples of chrominance information is 750, said first chrominance sampling frequency is 14.32 MHz and said second chrominance sampling frequency is 21.48 MHz.

10. An apparatus for creating a decrypted part of a MAC television signal comprising luminance information and/or chrominance information, said apparatus comprising:

input means (35) for receiving a scan line of television signal information;

storage means (38) coupled to the input means (35), the storage means (38) including first and second memory means (33, 34) adapted to store a scan line of said information and output means (37) adapted to subsequently read out the stored scan line of information to create the part of the MAC television signal; and

the part of the MAC signal being read out of the storage means (38) in accordance with a decryption key;

characterised in that first and second clock signal means (30, 31) are coupled to respective first and second memory means (33, 34),

wherein said first clock signal means (30) is adapted to cause said first memory means (33) to store a first present scan line of said information as a predetermined number of first samples at a first sampling frequency, and said second clock signal means (31) causes said second memory means (34) to read out a first stored scan line of information at said second sampling frequency whilst the first scan line is stored,

wherein said second clock signal means (31) is adapted to cause said second memory means (34) to store a second present scan line of said information as said predetermined number of second samples at said first sampling frequency, and said first clock signal means (30) causes said first memory means (33) to read out the stored first present scan line of information at said second sampling frequency whilst the first scan line is stored,

the first sampling frequency being greater than the second sampling frequency,

and wherein said first and second clock signal means (30,31) causes said first and second memory means (33, 34) to delay reading out said stored scan lines of said information in accordance with the decryption key.

11. The apparatus of claim 10 wherein said predetermined number of samples is 750, said first sampling frequency is 21.48 MHz and said second sampling frequency is 14.32 MHz.

12. The apparatus of claim 10 or 11, wherein said first and second memory means (33, 34) comprises RAM memory.

13. The apparatus of claim 10 or 11, wherein said first and second memory means (33, 34) comprises a plurality of shift registers.

14. The apparatus of claim 10 or 11, wherein said first and second memory means (33, 34) comprises a plurality of CCD elements.

15. The apparatus of claim 10, wherein said information comprises luminance information, the apparatus further comprising chrominance storage means (38b) coupled to said input means (35) for storing a scan line of said chrominance information and subsequently reading out said stored scan line of chrominance information to create another part of said MAC standard signal.

16. The apparatus of claim 15 wherein, said chrominance storage means (38b) includes first and second memory means (33, 34) coupled to said first and second clock signal means (30, 31) respectively, said first clock signal means (30) being arranged to cause said first memory means (33) of said chrominance storage means (38b) to store a first present scan line of said chrominance information when said second clock signal means (31) causes said second memory means (34) of said chrominance storage means (38b) to read out a first stored scan line of chrominance information, said second clock signal means (31)

being arranged to cause said second memory means (34) of said chrominance storage means (38b) to store a second present scan line of said chrominance information when said first clock signal means (30) causes said first memory means (33) of said chrominance storage means (38b) to read out the stored first present scan line of chrominance information, wherein said first and second clock signal means (30, 31) causes said first and second memory means (33, 34) of said chrominance storage means (38b) to delay reading out said stored scan lines of said chrominance information in accordance with said decryption key.

17. The apparatus of claim 16, wherein said first and second clock signal means (30, 31) causes said respective first and second memory means (33, 34) of said chrominance storage means (28b) to store a predetermined number of samples of said chrominance information at a first chrominance sampling frequency and to read out said stored scan line of chrominance information at a second chrominance sampling frequency.

18. The apparatus of claim 17, wherein said predetermined number of samples of chrominance information is 750, said first chrominance sampling frequency is 21.48 MHz and said second chrominance sampling frequency is 14.32 MHz.

19. A method of creating an encrypted part of a MAC television signal comprising luminance or chrominance information, comprising the steps of:

storing a first scan line of luminance or chrominance information as a predetermined number of first samples in one line store at a first sampling frequency;

storing a succeeding scan line of said information as said predetermined number of second samples in a second line store at the first predetermined sampling frequency;

commencing reading out the stored first scan line from the one line store at a second sampling frequency after a time delay determined by an encryption key whilst the succeeding scan line is being stored in the second line store at the first sampling frequency; and

commencing reading out the succeeding scan line from the second line store at the second sampling frequency after a time delay determined by the encryption key whilst the next succeeding scan line is being stored in the one line store at the first frequency;

wherein the second sampling frequency is greater than the first sampling frequency.

20. The method of claim 19 wherein said predetermined number of samples is 750, said first sampling frequency is 14.32 MHz, and said second sampling frequency is 21.48 MHz.

21. The method of claim 19 or 20, wherein the said information comprised luminance information, the method further comprising the steps of:

storing a first scan line of chrominance information as a predetermined number of third samples in a third line store at the first sampling frequency;

storing a succeeding scan line of chrominance information as said predetermined number of fourth samples in a fourth line store at the first sampling frequency;

commencing reading out the stored first scan line from the third line store at a second sampling frequency after a time delay determined by a decryption key whilst the succeeding scan line is being stored in the fourth line store at the first sampling frequency; and

commencing reading out the stored succeeding scan line from the fourth line store at a second sampling frequency after a time delay determined by said decryption key whilst the next succeeding scan line is being stored in the third line store at the first sampling frequency.

22. A method of creating a decrypted part of a MAC television signal comprising luminance or chrominance information, comprising the steps of:

storing a first scan line of said information as a predetermined number of first samples in one line store at a first sampling frequency;

storing a succeeding scan line of said information as said predetermined number of second samples in a second line store at said first sampling frequency;

commencing reading out the stored first scan line of luminance information from said one line store at a second sampling frequency after a time delay determined by a decryption key whilst the succeeding scan line is being stored in the second line store at the first sampling frequency;

commencing reading out the stored succeeding scan line of luminance information from said second line store at said second sampling frequency after a time delay determined by a decryption key whilst the next succeeding line is stored in the first line store at the first sampling frequency;

wherein the first sampling frequency is greater than the second sampling frequency.

23. The method of claim 22 wherein said predetermined number of samples is 750, said first sampling frequency is 21.48 MHz, and said second sampling frequency is 14.32 MHz.

24. The method of claim 22, wherein said information is luminance information, the method further comprising the steps of:

storing a first scan line of chrominance information as a predetermined number of third samples in a third line store at said first sampling frequency;

storing a second scan line of chrominance information as said predetermined number of fourth samples in a fourth line store at said first sampling frequency;

commencing reading out said stored first scan line of chrominance information from said third line store at a second predetermined sampling frequency after a time delay determined by a decryption key whilst the succeeding scan line is being stored in the fourth store at the first sampling frequency;

commencing reading out said stored succeeding scan line of chrominance information from said fourth line store at said second predetermined sampling frequency after a time delay determined by said decryption key whilst the next succeeding scan line of information is being stored in the third line store at the first sampling frequency.

Patentansprüche

1. Vorrichtung zur Erzeugung eines chiffrierten Abschnittes eines MAC-Fernsehsignals, das Luminanzinformation und/oder Chrominanzinformation enthält, welche Vorrichtung umfaßt:
eine Eingabeeinheit (35) zum Empfang einer Abtastzeile der Fernsehsignalinformation;
eine mit der Eingabeeinheit (35) verbundene Speichereinheit (38), die so ausgelegt ist, daß die Abtastzeile der Information gespeichert wird, und eine Ausgabeeinheit (37), die dazu ausgelegt ist, nachfolgend die gespeicherte Abtastzeile der Information auszulesen, um den entsprechenden Teil des MAC-Fernsehsignals zu erzeugen; und
wobei der entsprechende Teil des MAC-Fernsehsignals aus der Speichereinheit (38) entsprechend einem Chiffrierschlüssel ausgelesen wird, dadurch gekennzeichnet, daß die Speichereinheit (38) einen ersten und einen zweiten Speicher (33, 34) zum Speichern der Information und eine erste und zweite Taktsignaleinheit (30, 31) umfaßt, die jeweils mit dem ersten und zweiten Speicher (33, 34) gekoppelt ist,
wobei die erste Taktsignaleinheit (30) so ausgelegt ist, daß sie den ersten Speicher (33) veranlaßt, eine erste vorliegende Abtastzeile der Information als eine vorbestimmte Anzahl von ersten Abtastwerten mit einer ersten Abtastfrequenz zu speichern und wobei die zweite Taktsignaleinheit (31) den zweiten Speicher (34) veranlaßt, eine gespeicherte Abtastzeile der Information mit einer zweiten Abtastfrequenz auszulesen, während die erste vorliegende Abtastzeile gespeichert wird,
wobei die zweite Taktsignaleinheit (31) so ausgelegt ist, daß sie den zweiten Speicher (34) veranlaßt, eine zweite vorliegende Abtastzeile der Information als vorbestimmte Anzahl von zweiten Abtastwerten mit der ersten Abtastfrequenz zu speichern und wobei die erste Taktsignaleinheit (30) den ersten Speicher (33) veranlaßt, die gespeicherte erste vorliegende Abtastzeile von Information mit der zweiten Abtastfrequenz auszulesen, während die zweite vorliegende Abtastzeile gespeichert wird, wobei die zweite Abtastfrequenz größer ist als die erste Abtastfrequenz, und wobei die erste und zweite Tastsignaleinheit (30, 31) den jeweiligen ersten und zweiten Speicher (33, 34) veranlaßt, das Auslesen der gespeicherten Abtastzeilen der Information entsprechend dem Chiffrierschlüssel zu verzögern.

2. Vorrichtung nach Anspruch 1, wobei die vorbestimmte Anzahl 750, die erste Abtastfrequenz 14,32 MHz und die zweite Abtastfrequenz 21,48 MHz betragen.

3. Vorrichtung nach Anspruch 1 oder 2, wobei der erste und zweite Speicher (33, 34) einen RAM-Speicher umfaßt.

4. Vorrichtung nach Anspruch 1 oder 2, wobei der erste und zweite Speicher (33, 34) eine Vielzahl von Schieberegistern umfaßt.

5. Vorrichtung nach Anspruch 1 oder 2, wobei der erste und zweite Speicher (33, 34) eine Vielzahl von CCD-Elementen umfaßt.

6. Vorrichtung nach Anspruch 1 bis 5, wobei die Information eine Luminanz-Information umfaßt und die Vorrichtung weiterhin eine Chrominanz-Speichereinheit (38b) aufweist, die mit der Eingabeeinheit (35) zum Speichern einer Abtastzeile der Chrominanz-Information und zum darauffolgenden Auslesen der gespeicherten Abtastzeile der ChrominanzInformation gekoppelt ist, um einen weiteren Abschnitt des MAC-Standardsignals zu erzeugen.

7. Vorrichtung nach Anspruch 6, wobei die Chrominanz-Speichereinrichtung (38b) erste und zweite Speicher (33, 34) umfaßt, die jeweils mit ersten und zweiten Taktsignaleinrichtungen (30, 31) gekoppelt sind, welche erste Taktsignaleinrichtung (30) so angeordnet ist, daß sie der erste Speicher (33) der Chrominanz-Speichereinrichtung (38b)

veranlaßt, eine erste vorliegende Abtastzeile der Chrominanzinformation zu speichern, wenn die zweite Taktsignaleinrichtung (31) den zweiten Speicher (34) der Chrominanz-Speichereinrichtung (38b) veranlaßt, eine erste gespeicherte Abtastzeile der Chrominanzinformation auszulesen, wobei die zweite Taktsignaleinrichtung (31) so angeordnet ist, daß der zweite Speicher (34) der Chrominanz-Speichereinrichtung (38b) veranlaßt wird, eine zweite vorliegende Abtastzeile der Chrominanzinformation zu speichern, wenn die erste Taktsignaleinrichtung (30) den ersten Speicher (33) der Chrominanz-Speichereinrichtung (38b) veranlaßt, die gespeicherte erste vorliegende Abtastzeile der Chrominanzinformation auszulesen, wobei die erste und zweite Taktsignaleinrichtung (30, 31) den ersten und zweiten Speicher (33, 34) der Chrominanz-Speichereinrichtung (38b) veranlaßt, das Auslesen der gespeicherten Abtastzeilen der Chrominanzinformation entsprechend dem erwähnten Chiffrierschlüssel zu verzögern.

8. Vorrichtung nach Anspruch 7, wobei die erste und zweite Taktsignaleinrichtung (30, 31) jeweils den ersten und zweiten Speicher (33, 34) der Chrominanz-Speichereinrichtung (38b) veranlaßt, eine vorbestimmte Anzahl von Abtastwerten der Chrominanzinformation mit einer ersten Chrominanz-Abtastfrequenz zu speichern und die gespeicherte Abtastzeile der Chrominanzinformation mit einer zweiten Chrominanz-Abtastfrequenz auszulesen.

9. Vorrichtung nach Anspruch 8, wobei die vorbestimmte Anzahl von Abtastwerten der Chrominanzinformation 750, die erste Chrominanz-Abtastfrequenz 14,32 MHz und die zweite Chrominanz-Abtastfrequenz 21,48 MHz betragen.

10. Vorrichtung zur Erzeugung eines dechiffrierten Abschnittes eines MAC-Fernsehsignals, das Luminanzinformation und/oder Chrominanzinformation enthält, welche Vorrichtung umfaßt:
eine Eingabeeinrichtung (35) zum Empfangen einer Abtastzeile einer Fernsehsignalinformation;
eine mit der Eingabeeinrichtung (35) gekoppelte Speichereinrichtung (38), den ersten und zweiten Speicher (33, 34), die dazu ausgelegt sind, eine Abtastzeile der Information zu speichern, sowie eine Ausgabeeinrichtung (37) umfaßt, die dazu ausgelegt ist, nachfolgend die gespeicherte Abtastzeile der Information auszulesen, um den Abschnitt des MAC-Fernsehsignals zu erzeugen, und
wobei der Abschnitt des MAC-Signals aus der Speichereinrichtung (38) entsprechend einem Dechiffierschlüssel ausgelesen wird, dadurch gekennzeichnet, daß erste und zweite Taktsignaleinrichtungen (30, 31) mit jeweiligen ersten und zweiten Speichern (33, 34) gekoppelt sind,
wobei die erste Taktsignaleinrichtung (30) dazu ausgelegt ist, den ersten Speicher (33) zu veranlassen, eine erste vorliegende Abtastzeile der Information als eine vorbestimmte Anzahl von ersten Abtastwerten mit einer ersten Abtastfrequenz zu speichern und wobei die zweite Taktsignaleinrichtung (31) den zweiten Speicher (34) veranlaßt, eine erste gespeicherte Abtastzeile der Information mit einer zweiten Abtastfrequenz auszulesen, während die erste Abtastzeile gespeichert wird,
wobei die zweite Taktsignaleinrichtung (31) dazu ausgelegt ist, den zweiten Speicher (34) zu veranlassen, eine zweite vorliegende Abtastzeile der Information als vorbestimmte Anzahl von zweiten Abtastwerten mit der ersten Abtastfrequenz zu speichern und wobei die erste Taktsignaleinrichtung (31) den ersten Speicher (33) veranlaßt, die gespeicherte erste vorliegende Abtastzeile der Information mit der zweiten Abtastfrequenz auszulesen, während die erste Abtastzeile gespeichert wird,
wobei die erste Abtastfrequenz größer als die zweite Abtastfrequenz ist,
und wobei die erste und zweite Taktsignaleinrichtung (30, 31) den ersten und zweiten Speicher (33, 34) veranlaßt, das Auslesen der gespeicherten Abtastzeilen der Information entsprechend dem Dechiffrierschlüssel zu verzögern.

11. Vorrichtung nach Anspruch 10, wobei die vorbestimmte Anzahl von Abtastwerten 750, die erste Abtastfrequenz 21,48 MHz und die zweite Abtastfrequenz 14,32 MHz betragen.

12. Vorrichtung nach Anspruch 10 oder 11, wobei der erste und zweite Speicher (33, 34) einen RAM-Speicher umfaßt.

13. Vorrichtung nach Anspruch 10 oder 11, wobei der erste und zweite Speicher (33, 34) eine Vielzahl von Schieberegistern umfaßt.

14. Vorrichtung nach Anspruch 10 oder 11, wobei der erste und zweite Speicher (33, 34) eine Vielzahl von CCD-Elementen umfaßt.

15. Vorrichtung nach Anspruch 10, wobei die Information eine Luminanzinformation umfaßt, wobei die Vorrichtung weiterhin eine Chrominanz-Speichereinrichtung (38b) enthält, die mit der Eingabeeinrichtung (35) gekoppelt ist, um eine Abtastzeile der Chrominanz-information zu speichern und anschließend die gespeicherte Abtastzeile

der Chrominanzinformation auszulesen, um einen weiteren Abschnitt des MAC-Standardsignals zu erzeugen.

16. Vorrichtung nach Anspruch 15, wobei die Chrominanz-Speichereinrichtung (38b) einen ersten und zweiten Speicher (33, 34) umfaßt, die jeweils mit ersten und zweiten Taktsignaleinrichtungen (30, 31) gekoppelt sind, welche erste Taktsignaleinrichtung (30) so angeordnet ist, daß sie den ersten Speicher (33) der Chrominanz-Speichereinrichtung (38b) veranlaßt, eine erste vorliegende Abtastzeile der Chrominanzinformation zu speichern, wenn die zweite Taktsignaleinrichtung (31) den zweiten Speicher (34) der Chrominanz-Speichereinrichtung (38b) veranlaßt, eine erste gespeicherte Abtastzeile der Chrominanzinformation auszulesen, wobei die zweite Taktsignaleinrichtung (31) so angeordnet ist, daß die den zweiten Speicher (34) der Chrominanz-Speichereinrichtung (38b) veranlaßt, eine zweite vorliegende Abtastzeile der Chrominanzinformation zu speichern, wenn die erste Taktsignaleinrichtung (30) den ersten Speicher (33) der Chrominanz-Speichereinrichtung (38b) veranlaßt, die gespeicherte erste vorliegende Abtastzeile der Chrominanzinformation auszulesen, wobei die erste und zweite Taktsignaleinrichtung (30, 31) den ersten und zweiten Speicher (33, 34) der Chrominanz-Speichereinrichtung (38b) veranlaßt, das Auslesen der gespeicherten Abtastzeilen der Chrominanzinformation entsprechend dem erwähnten Dechiffrierschlüssel zu verzögern.

17. Vorrichtung nach Anspruch 16, wobei die erste Taktsignaleinrichtung (30, 32) jeweils den ersten und zweiten Speicher (33, 34) der Chrominanzspeichereinrichtung (38b) veranlaßt, eine vorbestimmte Anzahl von Abtastwerten der Chrominanzinformation mit einer ersten Chrominanz-Abtastfrequenz zu speichern und die gespeicherte Abtastzeile der Chrominanzinformation mit einer zweiten Chrominanz-Abtastfrequenz auszulesen.

18. Vorrichtung nach Anspruch 17, wobei die vorbestimmte Anzahl von Abtastwerten der Chrominanzinformation 750, die erste Chrominanz-Abtastfrequenz 21,48 MHz und die zweite Chrominanz-Abtastfrequenz 14,32 MHz betragen.

19. Verfahren zur Erzeugung eines chiffrierten Abschnittes eines MAC-Fernsehsignals, das Luminanz- oder Chrominanzinformation umfaßt, mit folgenden Verfahrensschritten:
Speichern einer ersten Abtastzeile von Luminanz- oder Chrominanz-information als vorbestimmte Anzahl von ersten Abtastwerten in einem Zeilenspeicher mit einer ersten Abtastfrequenz,
Speichern einer darauffolgenden Abtastzeile der Information als vorbestimmte Anzahl von zweiten Abtastwerten in einem zweiten Zeilenspeicher mit der ersten vorbestimmten Abtastfrequenz,
Beginnen des Auslesens der gespeicherten ersten Abtastzeile aus dem ersten Zeilenspeicher mit einer zweiten Abtastfrequenz nach einer Zeitverzögerung, die durch einen Chiffrierschlüssel bestimmt ist, während die nachfolgende Abtastzeile in dem zweiten Zeilenspeicher mit der ersten Abtastfrequenz gespeichert wird, und
Beginnen des Auslesens der nachfolgenden Abtastzeile aus dem zweiten Zeilenspeicher mit der zweiten Abtastfrequenz nach einer Zeitverzögerung, die durch den Chiffrierschlüssel bestimmt ist, während die nächste darauffolgende Abtastzeile in dem ersten Zeilenspeicher mit der ersten Frequenz gespeichert wird,
wobei die zweite Abtastfrequenz größer als die erste Abtastfrequenz ist.

20. Verfahren nach Anspruch 19, wobei die vorbestimmte Anzahl von Abtastwerten 750, die erste Abtastfrequenz 14,32 MHz und die zweite Abtastfrequenz 21,48 MHz betragen.

21. Verfahren nach Anspruch 19 oder 20, wobei die Information eine Luminanz-Information umfaßt, welches Verfahren weiterhin folgende Schritte umfaßt:
Speichern einer ersten Abtastzeile der Chrominanz-Information als vorbestimmte Anzahl von dritten Abtastwerten in einem dritten Zeilenspeicher mit der ersten Abtastfrequenz,
Speichern einer darauffolgenden Abtastzeile der Chrominanz-Information als vorbestimmte Anzahl von vierten Abtastwerten in einem vierten Zeilenspeicher mit der ersten Abtastfrequenz,
Beginnen des Auslesens der gespeicherten ersten Abtastzeile aus dem dritten Zeilenspeicher mit einer zweiten Abtastfrequenz nach einer Zeitverzögerung, die durch einen Chiffrierschlüssel bestimmt ist, während die darauffolgende Abtastzeile in dem vierten Zeilenspeicher mit der ersten Abtastfrequenz gespeichert wird, und
Beginnen des Auslesens der gespeicherten darauffolgenden Abtastzeile aus dem vierten Zeilenspeicher mit einer zweiten Abtastfrequenz nach einer Zeitverzögerung, die durch den Dechiffrierschlüssel bestimmt ist, während die nächste darauffolgende Abtastzeile in dem dritten Zeilenspeicher mit der ersten Abtastfrequenz gespeichert wird.

22. Verfahren zur Erzeugung eines dechiffrierten

Abschnittes eines MAC-Fernsehsignals, das Luminanz- oder Chrominanzinformation enthält, mit folgenden Verfahrensschritten:
Speichern einer ersten Abtastzeile der Information als vorbestimmte Anzahl von ersten Abtastwerten in einem ersten Zeilenspeicher mit einer ersten Abtastfrequenz,
Speichern einer darauffolgenden Abtastzeile der Information als vorbestimmte Anzahl von zweiten Abtastwerten in einem zweiten Zeilenspeicher mit einer ersten Abtastfrequenz,
Beginnen des Auslesens der gespeicherten ersten Abtastzeile der Luminanzinformation aus dem ersten Zeilenspeicher mit einer zweiten Abtastfrequenz nach einer Zeitverzögerung, die durch einen Dechiffrierschlüssel bestimmt ist, während die darauffolgenden Abtastzeile in dem zweiten Zeilenspeicher mit der ersten Abtastfrequenz gespeichert wird,
Beginnen des Auslesens der gespeicherten darauffolgenden Abtastzeile der Luminanzinformation aus dem zweiten Zeilenspeicher mit der zweiten Abtastfrequenz nach einer Zeitverzögerung, die durch einen Dechiffrierschlüssel bestimmt ist, während die nächste darauffolgende Zeile in dem ersten Zeilenspeicher mit der ersten Abtastfrequenz gespeichert wird,
wobei die erste Abtastfrequenz größer als die zweite Abtastfrequenz ist.

23. Verfahren nach Anspruch 22, wobei die vorbestimmte Anzahl von Abtastwerten 750 die erste Abtastfrequenz 21,48 MHz und die zweite Abtastfrequenz 14,32 MHz betragen.

24. Verfahren nach Anspruch 22, wobei die Information eine Luminanzinformation ist, welches Verfahren weiterhin folgende Schritte umfaßt:
Speichern einer ersten Abtastzeile der Chrominanzinformation als vorbestimmte Anzahl von dritten Abtastwerten in einem dritten Zeilenspeicher mit der ersten Abtastfrequenz,
Speichern einer zweiten Abtastzeile der Chrominanzinformation als vorbestimmte Anzahl von vierten Abtastwerten in einem vierten Zeilenspeicher mit der ersten Abtastfrequenz,
Beginnen des Auslesens der gespeicherten ersten Abtastzeile der Chrominanzinformation aus dem dritten Zeilenspeicher mit einer zweiten vorbestimmten Abtastfrequenz nach einer Zeitverzögerung, die durch einen Dechiffrierschlüssel bestimmt ist, während die darauffolgende Abtastzeile in dem vierten Speicher mit der ersten Abtastfrequenz gespeichert wird,
Beginnen des Auslesens der gespeicherten darauffolgenden Abtastzeile der Chrominanzinformation aus dem vierten Zeilenspeicher mit einer zweiten vorbestimmten Abtastfrequenz nach einer Zeitverzögerung, die durch den Dechiffrierschlüssel bestimmt ist, während die nächste darauffolgende Abtastzeile der Information in dem dritten Zeilenspeicher mit der ersten Abtastfrequenz gespeichert wird.

Revendications

1. Appareil pour créer une partie cryptée d'un signal de télévision MAC comprenant l'information luminance et/ou l'information chrominance, ledit appareil comprenant:
   - un moyen d'entrée (35) pour recevoir une ligne de balayage d'information relative au signal de télévision;
   - un moyen de mémorisation (38) raccordé au moyen d'entrée (35), le moyen de mémorisation (38) étant adapté pour mémoriser ladite ligne de balayage de ladite information, et un moyen de sortie (37) adapté pour lire ensuite la ligne de balayage mémorisée d'information pour créer la partie du signal de télévision MAC; et
   - la partie du signal de télévision MAC étant lue dans le moyen de mémorisation (38) en fonction d'une clé de cryptage;

   caractérisé par le fait que le moyen de mémorisation (38) comprend des premier et second moyens mémoire (33, 34) pour mémoriser ladite information et des premier et second moyens signal d'horloge (30, 31) raccordés aux premier et second moyens mémoire correspondants (33, 34);
   où ledit premier moyen signal d'horloge (30) est adapté pour que ledit premier moyen mémoire (33) mémorise une présente première ligne de balayage de ladite information sous la forme d'un nombre prédéterminé de premiers échantillons à une première fréquence d'échantillonnage, et ledit second moyen signal d'horloge (31) est adapté pour que ledit second moyen mémoire (34) lise une ligne de balayage mémorisée d'information à une seconde fréquence d'échantillonnage tandis que la présente première ligne de balayage est mémorisée;
   où ledit second moyen signal d'horloge (31) est adapté pour que ledit second moyen mémoire (34) mémorise une présente seconde ligne de balayage de ladite information sous la forme dudit nombre prédéterminé de seconds échantillons à la première fréquence d'échantillonnage et ledit premier moyen signal d'horloge (30) est adapté pour que ledit premier moyen mémoire (33) lise la présente première ligne de balayage mémorisée d'information à la seconde fréquence d'échantillonnage, alors que la présente seconde ligne de balayage est mémorisée, la seconde fréquence

d'échantillonnage étant supérieure à la première fréquence d'échantillonnage, et où lesdits premier et second moyens signal d'horloge (30, 31) sont adaptés pour que les premier et second moyens mémoire correspondants (33, 34) retardent la lecture desdites lignes de balayage mémorisées d'information en fonction de ladite clé de cryptage.

2. Appareil selon la revendication 1, dans lequel ledit nombre prédéterminé est 750, ladite première fréquence d'échantillonnage est 14,32 MHz, et ladite seconde fréquence d'échantillonnage est 21,48 MHz.

3. Appareil selon l'une des revendications 1 et 2, dans lequel lesdits premier et second moyens mémoire (33, 34) comprennent une mémoire RAM.

4. Appareil selon l'une des revendications 1 et 2, dans lequel lesdits premier et second moyens mémoire (33, 34) comprennent une pluralité de registres à décalage.

5. Appareil selon l'une des revendications 1 et 2, dans lequel lesdits premier et second moyens mémoire (33, 34) comprennent une pluralité d'éléments CCD.

6. Appareil selon l'une des revendications 1 à 5, dans lequel ladite information comprend l'information luminance, l'appareil comprenant en outre un moyen de mémorisation de chrominance (38b) raccordé audit moyen d'entrée (35) pour mémoriser une ligne de balayage de ladite information de chrominance et lire ensuite ladite ligne de balayage mémorisée d'information chrominance pour créer une autre partie dudit signal à la norme MAC.

7. Appareil selon la revendication 6, dans lequel ledit moyen de mémorisation de chrominance (38b) comprend des premier et second moyens mémoire (33, 34) raccordés respectivement auxdits premier et second moyens signal d'horloge (30, 31), ledit premier moyen signal d'horloge (30) ayant pour fonction que ledit premier moyen mémoire (33) dudit moyen de mémorisation de chrominance (38b) mémorise une présente ligne de balayage de ladite information chrominance lorsque ledit second moyen signal d'horloge (31) pilote ledit second moyen mémoire (34) dudit moyen de mémorisation de chrominance (38b) pour qu'il lise une première ligne de balayage mémorisée d'information chrominance, ledit second moyen signal d'horloge (31) ayant pour fonction que ledit second moyen mémoire (34) dudit moyen de mémorisation de chrominance (38b) mémorise une présente seconde ligne de balayage de ladite information chrominance lorsque ledit premier moyen signal d'horloge (30) pilote ledit premier moyen mémoire (33) dudit moyen de mémorisation de chrominance (38b) pour qu'il lise la présente première ligne de balayage mémorisée d'information chrominance, où lesdits premier et second moyens signal d'horloge (30, 31) pilotent lesdits premier et second moyens mémoire (33, 34) dudit moyen de mémorisation de chrominance (38b) pour qu'ils retardent la lecture desdites lignes de balayage mémorisées de ladite information chrominance en fonction de ladite clé de cryptage.

8. Appareil selon la revendication 7, dans lequel lesdits premier et second moyens signal d'horloge (30, 31) pilotent lesdits premier et second moyens mémoire correspondants (33, 34) dudit moyen de mémorisation de chrominance (38b) pour qu'ils mémorisent un nombre prédéterminé d'échantillons de ladite information chrominance à une première fréquence d'échantillonnage de chrominance et lisent ladite ligne de balayage mémorisée d'information chrominance à une seconde fréquence d'échantillonnage de chrominance.

9. Appareil selon la revendication 8, dans lequel ledit nombre prédéterminé d'échantillons d'information chrominance est 750, ladite première fréquence d'échantillonnage de chrominance est 14,32 MHz, et ladite seconde fréquence d'échantillonnage de chrominance est 21,48 MHz.

10. Appareil pour créer une partie décryptée d'un signal de télévision MAC comprenant l'information luminance et/ou l'information chrominance, ledit appareil comprenant:
    - un moyen d'entrée (35) pour recevoir une ligne de balayage d'information relative au signal de télévision;
    - un moyen de mémorisation (38) raccordé au moyen d'entrée (35), le moyen de mémorisation (38) comprenant des premier et second moyens mémoire (33, 34) adaptés pour mémoriser une ligne de balayage de ladite information et un moyen de sortie (37) adapté pour lire ensuite la ligne de balayage mémorisée d'information pour créer la partie du signal de télévision MAC; et
    - la partie du signal MAC étant lue dans le moyen de mémorisation (38) en fonction d'une clé de décryptage;

    caractérisé par le fait que des premier et second moyens signal d'horloge (30, 31) sont raccordés aux premier et second moyens mémoire corres-

pondants (33, 34), où ledit premier moyen signal d'horloge (30) est adapté pour que ledit premier moyen mémoire (33) mémorise une présente première ligne de balayage de ladite information sous la forme d'un nombre prédéterminé de premiers échantillons à une première fréquence d'échantillonnage, et ledit second moyen signal d'horloge (31) pilote ledit second moyen mémoire (34) pour qu'il lise une première ligne de balayage mémorisée d'information à ladite seconde fréquence d'échantillonnage tandis que la première ligne de balayage est mémorisée,
où ledit second moyen signal d'horloge (31) est adapté pour que ledit second moyen mémoire (34) mémorise une présente seconde ligne de balayage de ladite information sous la forme dudit nombre prédéterminé de seconds échantillons à ladite première fréquence d'échantillonnage, et ledit premier moyen signal d'horloge (30) pilote ledit premier moyen mémoire (33) pour qu'il lise la présente première ligne de balayage mémorisée d'information à ladite seconde fréquence d'échantillonnage tandis que la première ligne de balayage est mémorisée,
la première fréquence d'échantillonnage étant supérieure à la seconde fréquence d'échantillonnage,
et où lesdits premier et second moyens signal d'horloge (30, 31) pilotent lesdits premier et second moyens mémoire (33, 34) pour qu'ils retardent la lecture desdites lignes de balayage mémorisées de ladite information en fonction de la clé de décryptage.

11. Appareil selon la revendication 10, dans lequel ledit nombre prédéterminé d'échantillons est 750, ladite première fréquence d'échantillonnage est 21,48 MHz, et ladite seconde fréquence d'échantillonnage est 14,32 MHz.

12. Appareil selon l'une des revendications 10 et 11, dans lequel lesdits premier et second moyens mémoire (33, 34) comprennent une mémoire RAM.

13. Appareil selon l'une des revendications 10 et 11, dans lequel lesdits premier et second moyens mémoire (33, 34) comprennent une pluralité de registres à décalage.

14. Appareil selon l'une des revendications 10 et 11, dans lequel lesdits premier et second moyens mémoire (33, 34) comprennent une pluralité d'éléments CCD.

15. Appareil selon la revendication 10, dans lequel ladite information comprend l'information luminance, l'appareil comprenant en outre un moyen de mémorisation de chrominance (38b) raccordé audit moyen d'entrée (35) pour mémoriser une ligne de balayage de ladite information chrominance et lire ensuite ladite ligne de balayage mémorisée d'information chrominance pour créer une autre partie dudit signal à la norme MAC.

16. Appareil selon la revendication 15, dans lequel ledit moyen de mémorisation de chrominance (38b) comprend des premier et second moyens mémoire (33, 34) raccordés respectivement auxdits premier et second moyens signal d'horloge (30, 31), ledit premier moyen signal d'horloge (30) ayant pour fonction que ledit premier moyen mémoire (33) dudit moyen de mémorisation de chrominance (38b) mémorise une présente première ligne de balayage de ladite information chrominance lorsque ledit second moyen signal d'horloge (31) pilote ledit second moyen mémoire (34) dudit moyen de mémorisation de chrominance (38b) pour qu'il lise une première ligne de balayage mémorisée d'information chrominance, ledit second moyen signal d'horloge (31) ayant pour fonction que ledit second moyen mémoire (34) dudit moyen de mémorisation de chrominance (38b) mémorise une présente seconde ligne de balayage de ladite information chrominance lorsque ledit premier moyen signal d'horloge (30) pilote ledit premier moyen mémoire (33) dudit moyen de mémorisation de chrominance (38b) pour qu'il lise la présente première ligne de balayage mémorisée d'information chrominance, où lesdits premier et second moyens signal d'horloge (30, 31) pilotent lesdits premier et second moyens mémoire (33, 34) dudit moyen de mémorisation de chrominance (38b) pour qu'ils retardent la lecture desdites lignes de balayage mémorisées de ladite information chrominance en fonction de ladite clé de décryptage.

17. Appareil selon la revendication 16, dans lequel lesdits premier et second moyens signal d'horloge (30, 31) pilotent lesdits premier et second moyens mémoire correspondants (33, 34) dudit moyen de mémorisation de chrominance (38b) pour qu'ils mémorisent un nombre prédéterminé d'échantillons de ladite information chrominance à une première fréquence d'échantillonnage de chrominance et lisent ladite ligne de balayage mémorisée d'information chrominance à une seconde fréquence d'échantillonnage de chrominance.

18. Appareil selon la revendication 17, dans lequel ledit nombre prédéterminé d'échantillons d'information chrominance est 750, ladite première fréquence d'échantillonnage de chrominance est 21,48 MHz et ladite seconde fréquence d'échan-

tillonnage de chrominance est 14,32 MHz.

19. Procédé de création d'une partie cryptée d'un signal de télévision MAC comprenant l'information luminance ou chrominance, comprenant les étapes de:
    - mémorisation d'une première ligne de balayage d'information luminance ou chrominance sous la forme d'un nombre prédéterminé de premiers échantillons dans une mémoire de ligne à une première fréquence d'échantillonnage;
    - mémorisation d'une ligne de balayage suivante de ladite information sous la forme dudit nombre prédéterminé de seconds échantillons dans une seconde mémoire de ligne à la première fréquence d'échantillonnage prédéterminée;
    - début de lecture de la première ligne de balayage mémorisée dans la première mémoire de ligne à une seconde fréquence d'échantillonnage après un retard déterminé par une clé de cryptage tandis que la ligne de balayage suivante est mémorisée dans la seconde mémoire de ligne à la première fréquence d'échantillonnage; et
    - début de lecture de la ligne de balayage suivante dans la seconde mémoire de ligne à la seconde fréquence d'échantillonnage après un retard déterminé par la clé de cryptage tandis que la ligne de balayage suivante est mémorisée dans la première mémoire de ligne à la première fréquence;

    où la seconde fréquence d'échantillonnage est supérieure à la première fréquence d'échantillonnage.

20. Procédé selon la revendication 19, dans lequel ledit nombre prédéterminé d'échantillons est 750, ladite première fréquence d'échantillonnage est 14,32 MHz, et ladite seconde fréquence d'échantillonnage est 21,48 MHz.

21. Procédé selon l'une des revendications 19 ou 20, dans lequel ladite information comprend l'information luminance, le procédé comprenant en outre les étapes de:
    - mémorisation d'une première ligne de balayage d'information chrominance sous la forme d'un nombre prédéterminé de troisièmes échantillons dans une troisième mémoire de ligne à la première fréquence d'échantillonnage;
    - mémorisation d'une ligne de balayage suivante d'information chrominance sous la forme dudit nombre prédéterminé de quatrièmes échantillons dans une quatrième mémoire de ligne à la première fréquence d'échantillonnage;
    - début de lecture de la première ligne de balayage mémorisée dans la troisième mémoire de ligne à une seconde fréquence d'échantillonnage après un retard déterminé par une clé de décryptage tandis que la ligne de balayage suivante est mémorisée dans la quatrième mémoire de ligne à la première fréquence d'échantillonnage; et
    - début de lecture de la ligne de balayage suivante mémorisée dans la quatrième mémoire de ligne à une seconde fréquence d'échantillonnage après un retard déterminé par ladite clé de décryptage tandis que la ligne de balayage suivante est mémorisée dans la troisième mémoire de ligne à la première fréquence d'échantillonnage.

22. Procédé de création d'une partie décryptée d'un signal de télévision MAC comprenant l'information luminance ou chrominance, comprenant les étapes de:
    - mémorisation d'une première ligne de balayage de ladite information sous la forme d'un nombre prédéterminé de premiers échantillons dans une première mémoire de ligne à une première fréquence d'échantillonnage;
    - mémorisation d'une ligne de balayage suivante de ladite information sous la forme dudit nombre prédéterminé de seconds échantillons dans une seconde mémoire de ligne à ladite première fréquence d'échantillonnage;
    - début de lecture de la première ligne de balayage mémorisée d'information luminance dans ladite première mémoire de ligne à une seconde fréquence d'échantillonnage après un retard déterminé par une clé de décryptage tandis que la ligne de balayage suivante est mémorisée dans la seconde mémoire de ligne à la première fréquence d'échantillonnage;
    - début de lecture de la ligne de balayage suivante mémorisée d'information luminance dans ladite seconde mémoire de ligne à ladite seconde fréquence d'échantillonnage après un retard déterminé par une clé de décryptage tandis que la ligne suivante est mémorisée dans la première mémoire de ligne à la première fréquence d'échantillonnage;

    où la première fréquence d'échantillonnage est supérieure à la seconde fréquence d'échantillonnage.

23. Procédé selon la revendication 22, dans lequel ledit nombre prédéterminé d'échantillons est

750, ladite première fréquence d'échantillonnage est 21,48 MHz, et ladite seconde fréquence d'échantillonnage est 14,32 MHz.

24. Procédé selon la revendication 22, dans lequel ladite information est l'information luminance, le procédé comprenant en outre les étapes de:
    - mémorisation d'une première ligne de balayage d'information chrominance sous la forme d'un nombre prédéterminé de troisièmes échantillons dans une troisième mémoire de ligne à ladite première fréquence d'échantillonnage;
    - mémorisation d'une seconde ligne de balayage d'information chrominance sous la forme dudit nombre prédéterminé de quatrièmes échantillons dans une quatrième mémoire de ligne à ladite première fréquence d'échantillonnage ;
    - début de lecture de ladite première ligne de balayage mémorisée d'information chrominance dans ladite troisième mémoire de ligne à une seconde fréquence d'échantillonnage prédéterminée après un retard déterminé par une clé de décryptage tandis que la ligne de balayage suivante est mémorisée dans la quatrième mémoire à la première fréquence d'échantillonnage;
    - début de lecture de ladite ligne de balayage suivante mémorisée d'information chrominance dans ladite quatrième mémoire de ligne à ladite seconde fréquence d'échantillonnage prédéterminée après un retard déterminé par ladite clé de décryptage tandis que la ligne de balayage suivante d'information est mémorisée dans la troisième mémoire de ligne à la première fréquence d'échantillonnage.

FIG. 1.

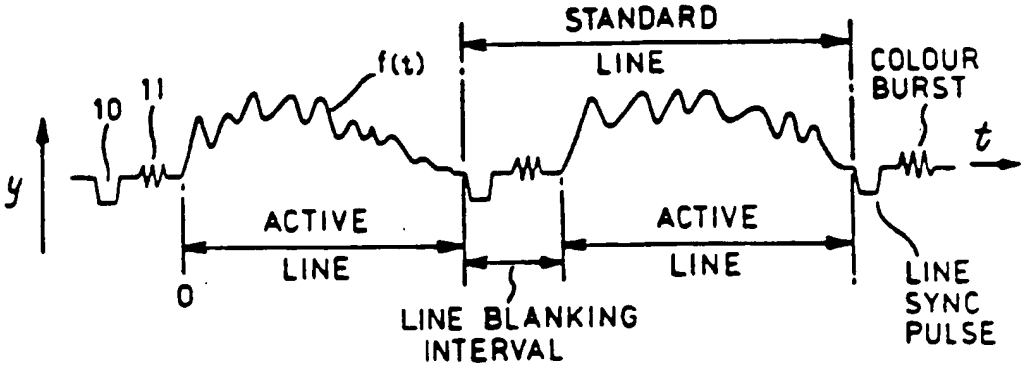


FIG. 2a.

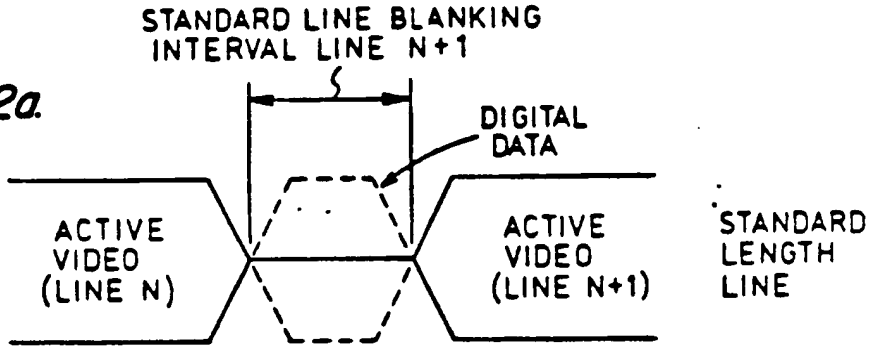


FIG. 2b.

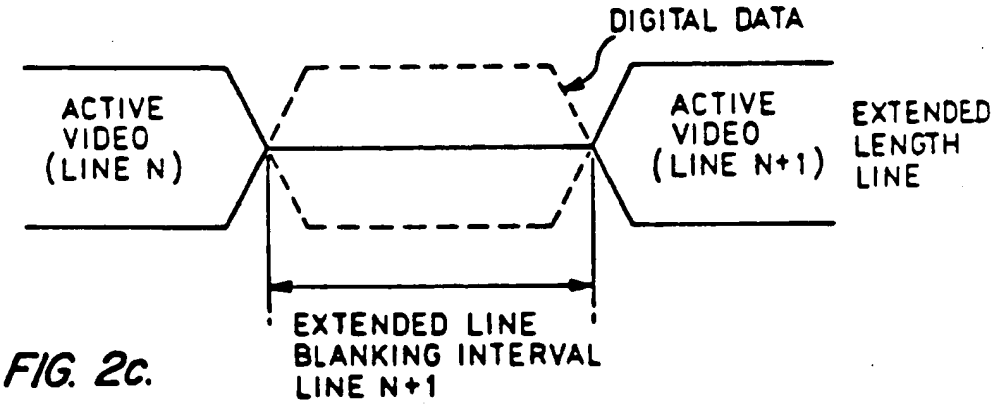


FIG. 2c.

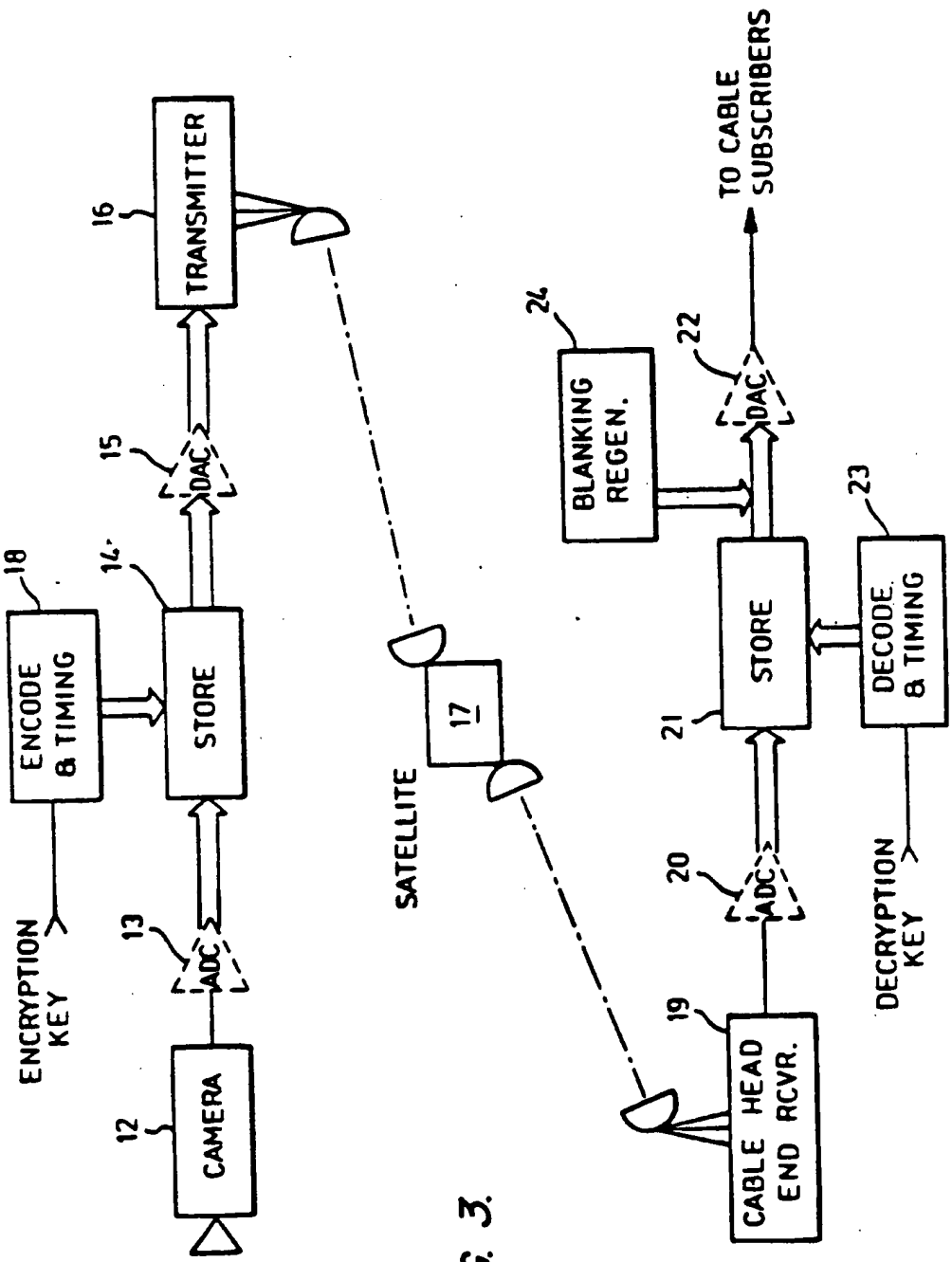

CAMERA
12
ADC
13
ENCRYPTION KEY
ENCODE & TIMING
18
STORE
14
DAC
15
TRANSMITTER
16
SATELLITE
17
CABLE HEAD END RCVR.
19
ADC
20
STORE
21
DAC
22
BLANKING REGEN.
24
DECODE & TIMING
23
DECRYPTION KEY
TO CABLE SUBSCRIBERS

FIG. 3.

FIG. 4.

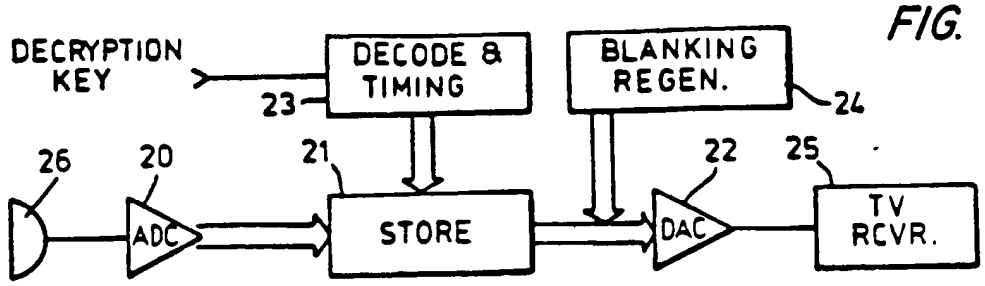


FIG. 5.

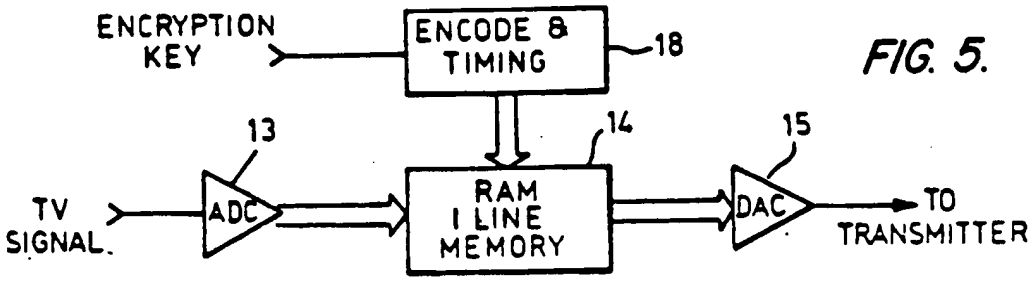


FIG. 6.

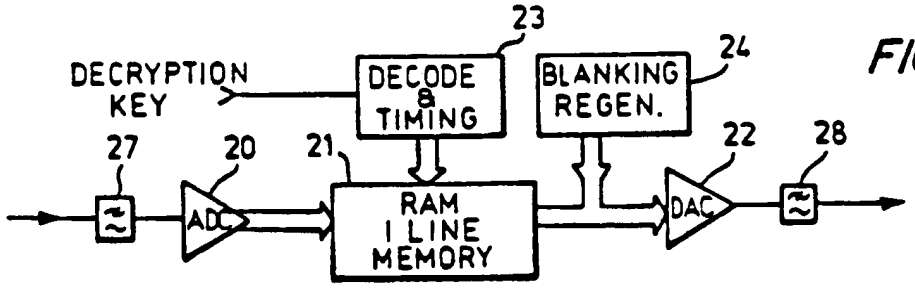


FIG. 7.

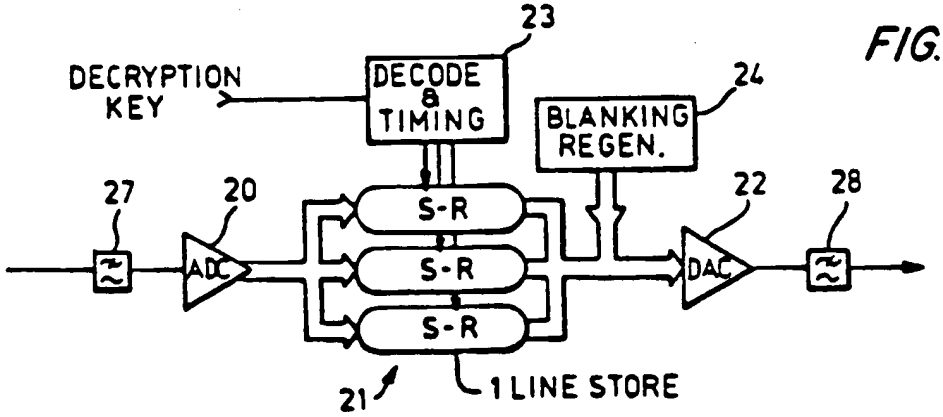
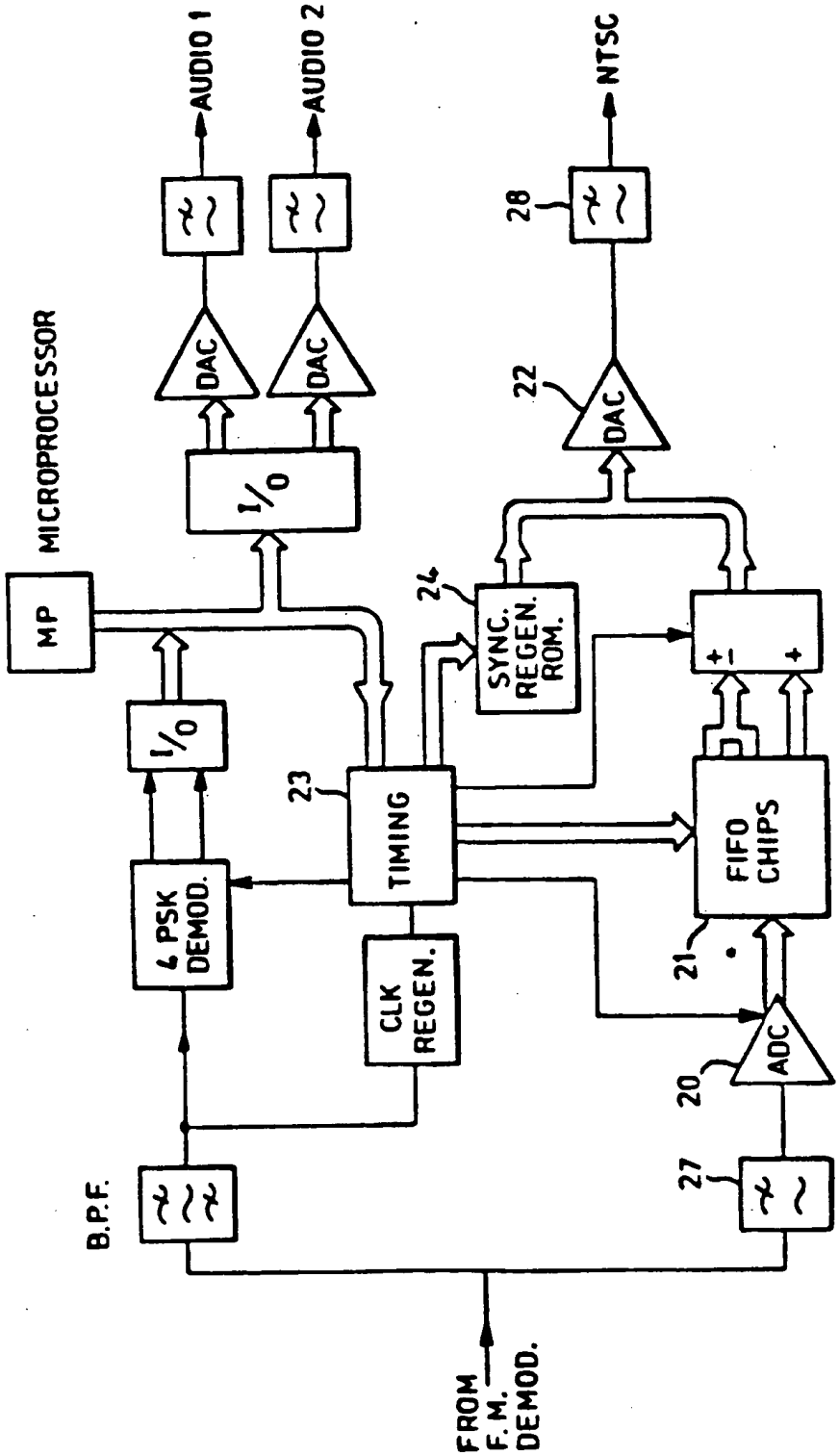


FIG. 8.


AUDIO 1
AUDIO 2
NTSC
MICROPROCESSOR
MP
DAC
DAC
DAC
I/O
I/O
28
22
24
SYNC. REGEN. ROM.
23
TIMING
4 PSK DEMOD.
CLK REGEN.
FIFO CHIPS
21
ADC
20
27
B.P.F.
FROM F.M. DEMOD.

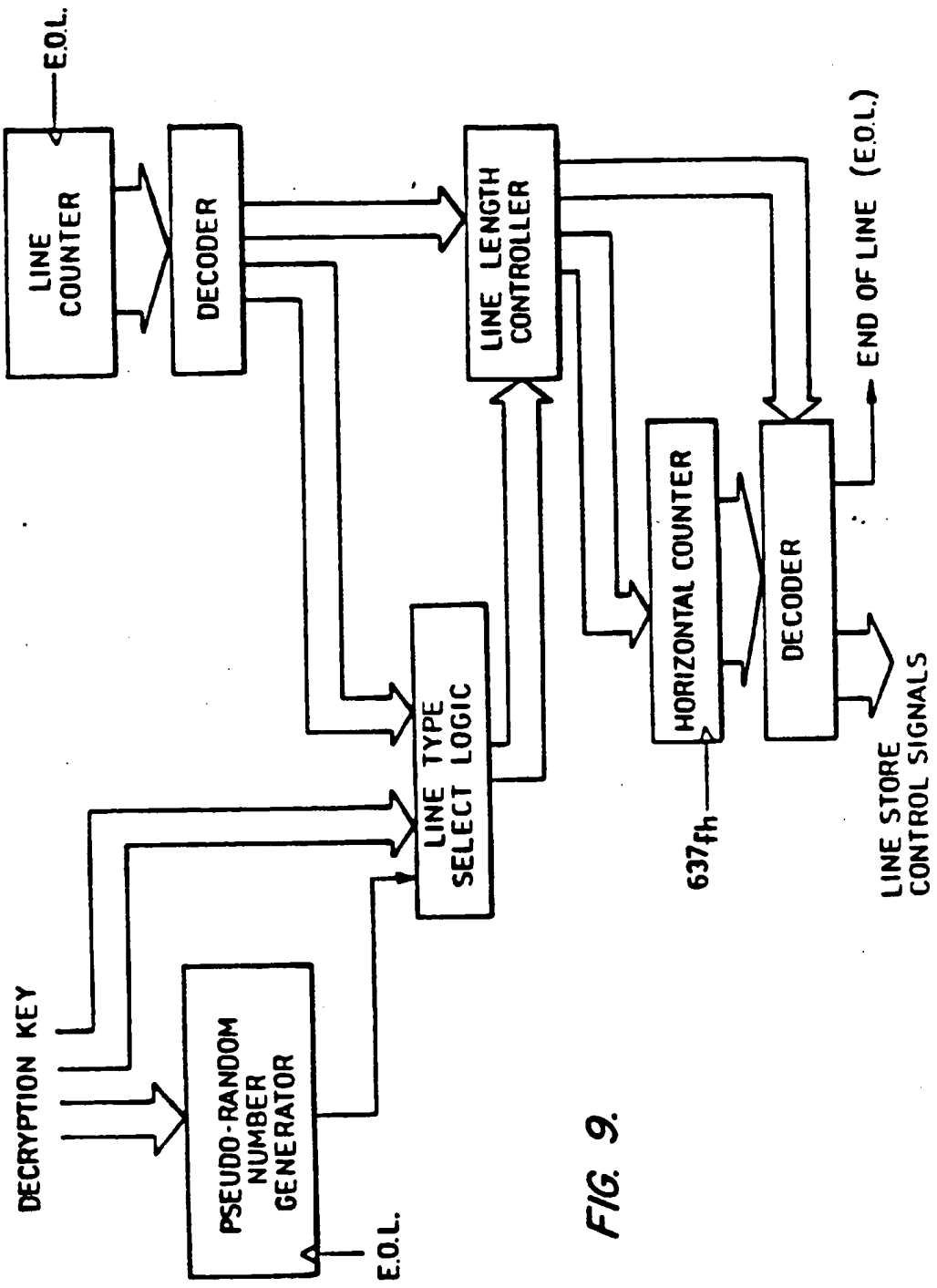

E.O.L.
LINE COUNTER
DECODER
LINE LENGTH CONTROLLER
END OF LINE (E.O.L.)
LINE TYPE SELECT LOGIC
HORIZONTAL COUNTER
DECODER
637fh
LINE STORE CONTROL SIGNALS
DECRYPTION KEY
PSEUDO-RANDOM NUMBER GENERATOR
E.O.L.

FIG. 9.

FIG. 10.
PRIOR ART

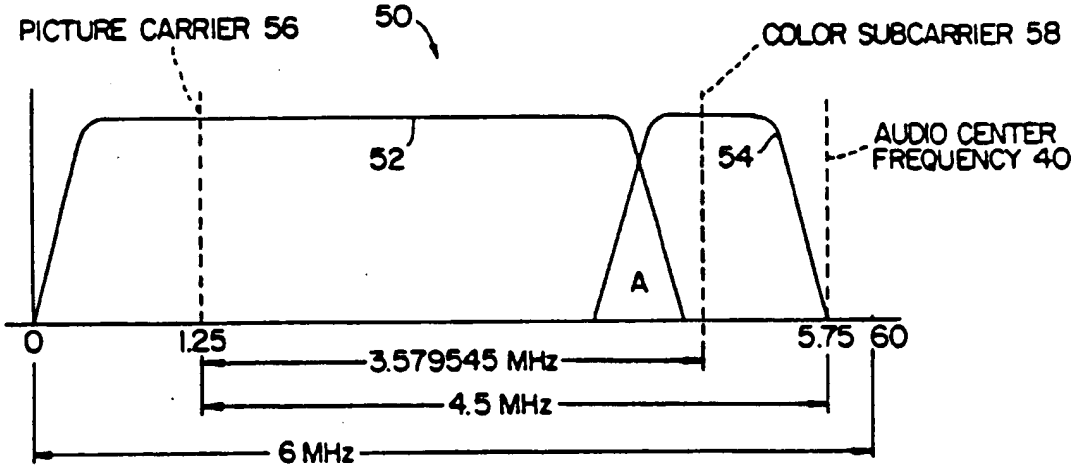


FIG. 11.
PRIOR ART

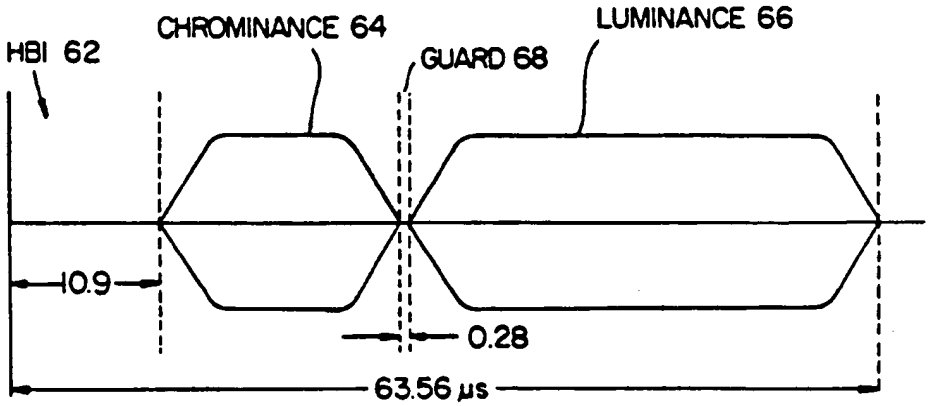


FIG. 12.

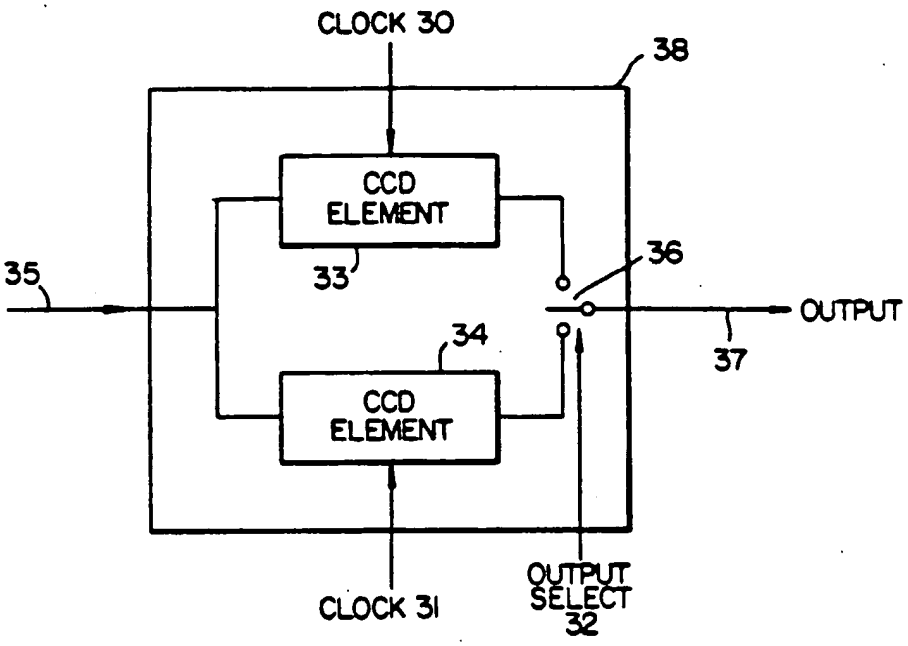

CLOCK 30
38
CCD ELEMENT
33
35
36
OUTPUT
37
34
CCD ELEMENT
CLOCK 31
OUTPUT SELECT 32

FIG. 13.

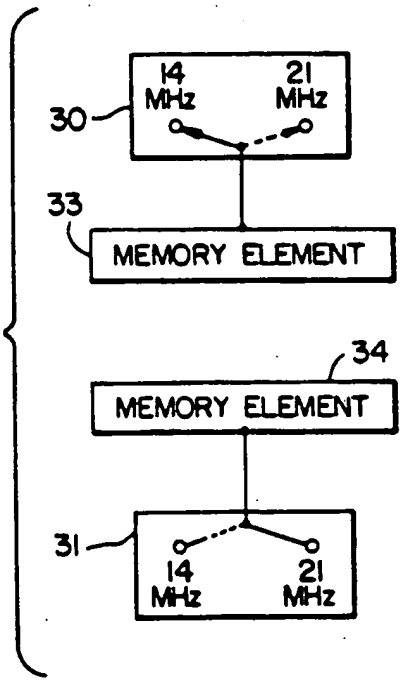
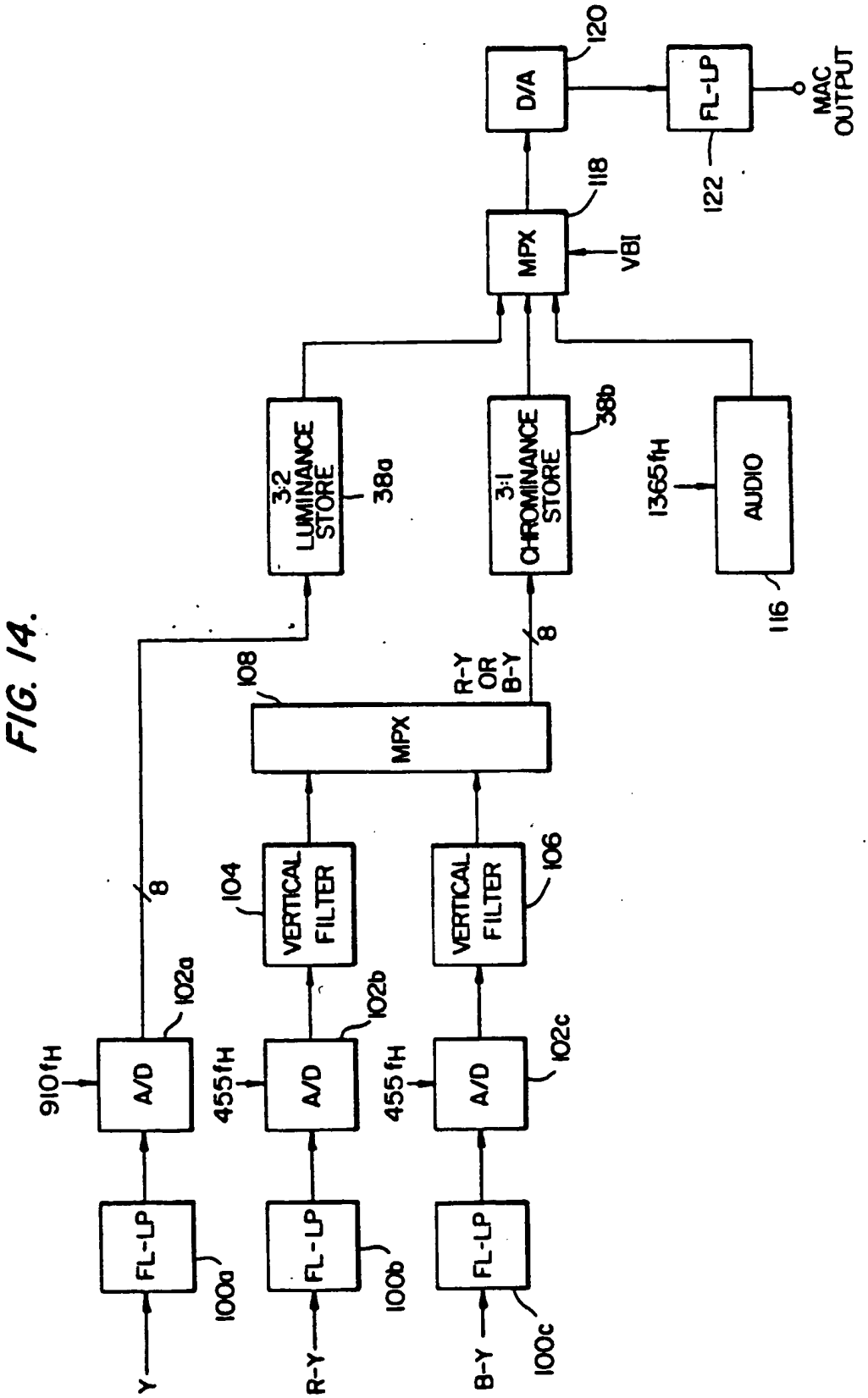

14 MHz
21 MHz
30
33
MEMORY ELEMENT
34
MEMORY ELEMENT
31
14 MHz
21 MHz

FIG. 14.


Y
R-Y
B-Y
100a
100b
100c
FL-LP
FL-LP
FL-LP
910fH
455fH
455fH
A/D
A/D
A/D
102a
102b
102c
8
104
VERTICAL FILTER
VERTICAL FILTER
106
MPX
108
R-Y OR B-Y
8
3:2 LUMINANCE STORE
38a
3:1 CHROMINANCE STORE
38b
13.65fH
AUDIO
116
MPX
118
VBI
D/A
120
FL-LP
122
MAC OUTPUT

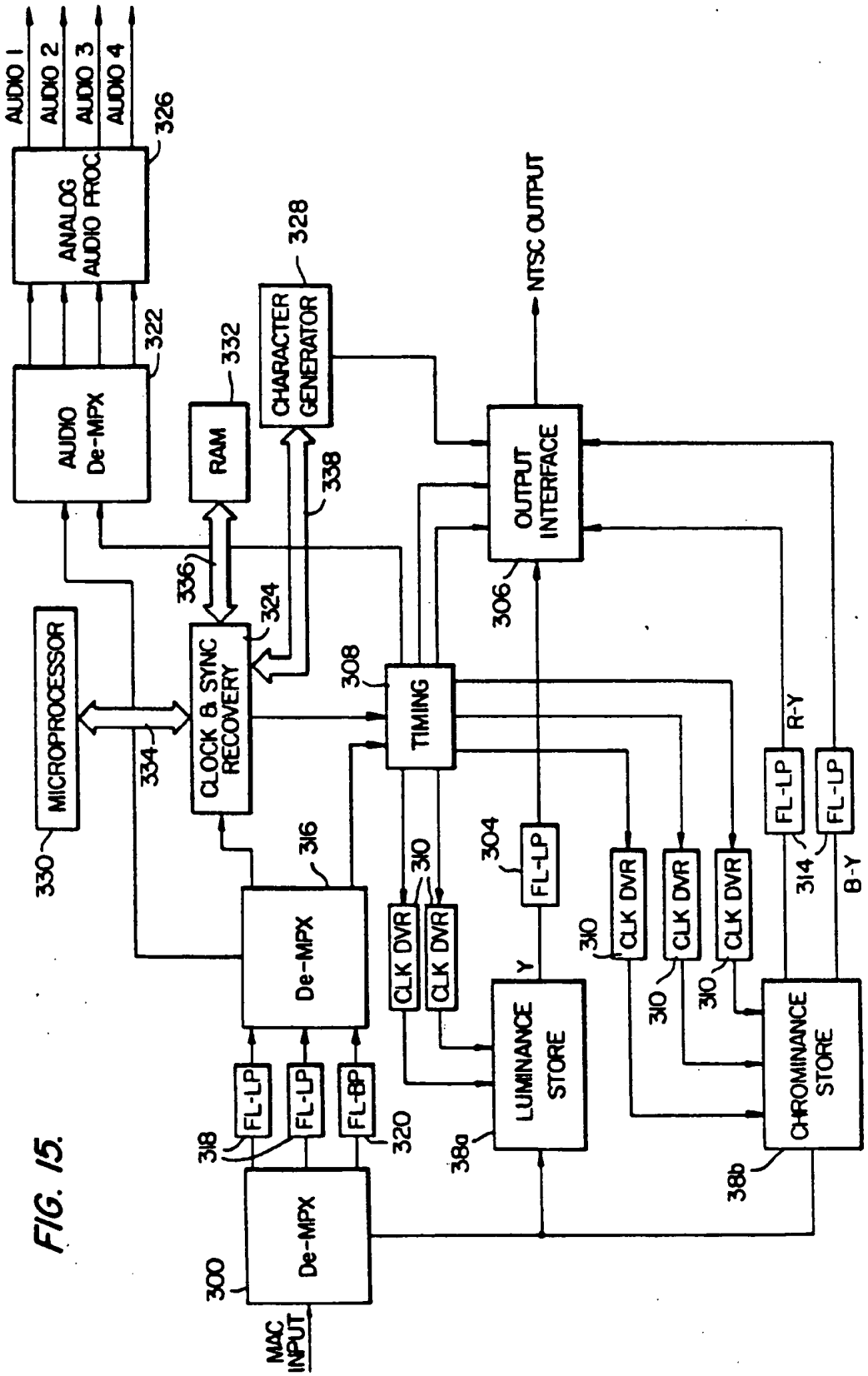

AUDIO 1
AUDIO 2
AUDIO 3
AUDIO 4
326
ANALOG AUDIO PROC
322
AUDIO De-MPX
332
RAM
328
CHARACTER GENERATOR
NTSC OUTPUT
OUTPUT INTERFACE
306
338
336
324
MICROPROCESSOR
330
334
CLOCK & SYNC RECOVERY
308
TIMING
316
De-MPX
340
CLK DVR
CLK DVR
304
FL-LP
Y
LUMINANCE STORE
38a
310
CLK DVR
CLK DVR
CLK DVR
FL-LP
FL-LP
R-Y
B-Y
314
CHROMINANCE STORE
38b
FL-LP
FL-LP
FL-BP
318
320
De-MPX
300
MAC INPUT

FIG. 15.

FIG. 16a.

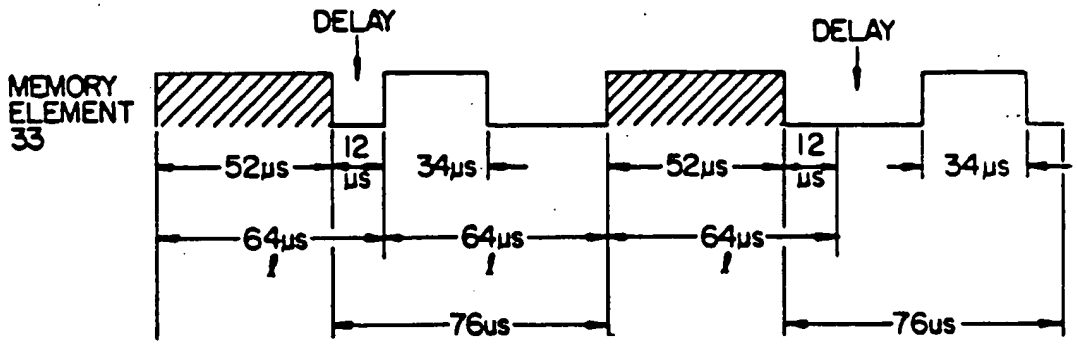


FIG. 16b.